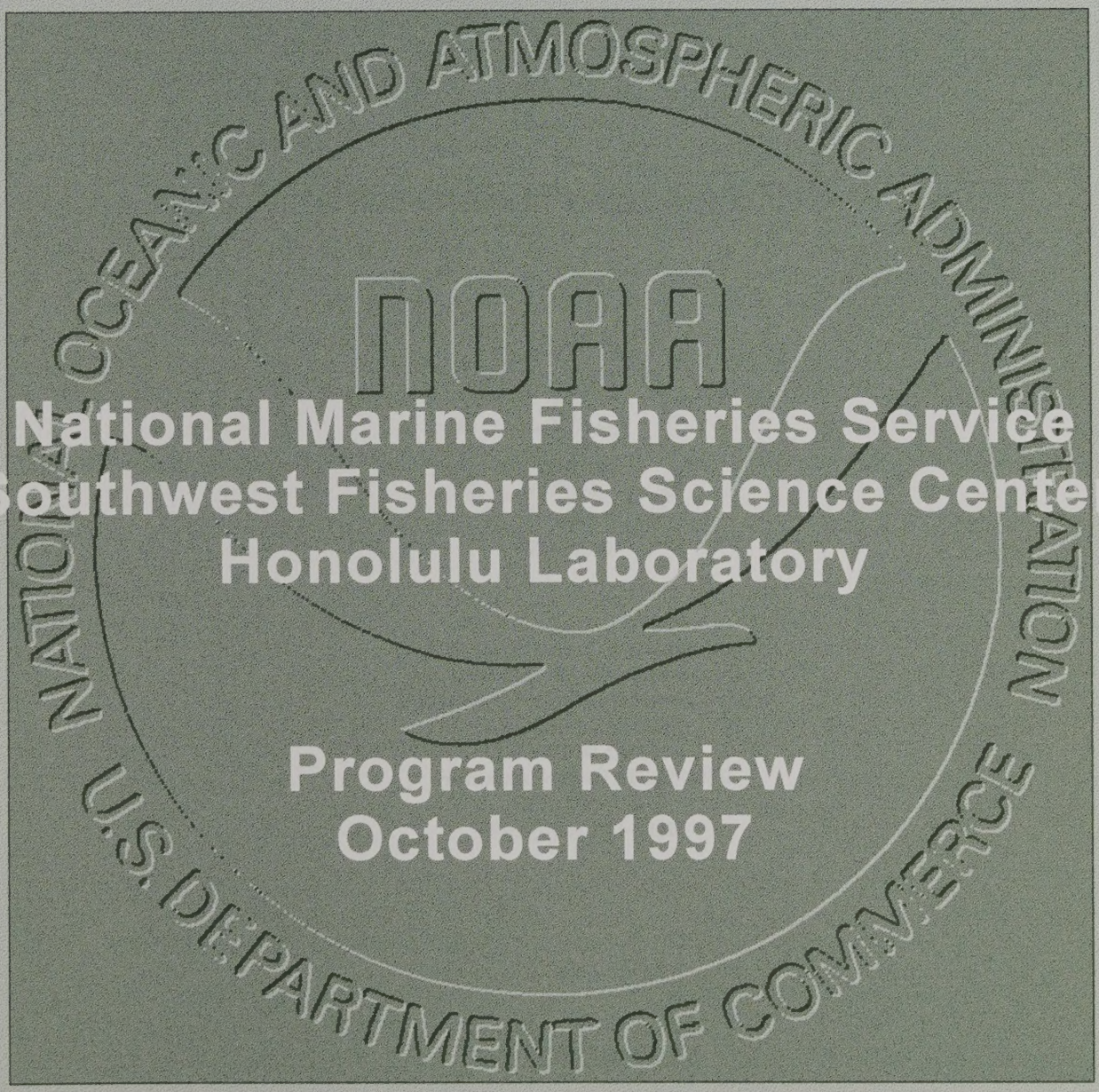

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1997 PROGRAM REVIEW

HONOLULU LABORATORY

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1977 PROGRAM REVIEW

HONOLULU LABORATORY

Preface

This report was prepared for the annual review of the NMFS Honolulu Laboratory by the management team of the Southwest Fisheries Science Center. Because it provides a broad overview of Honolulu Laboratory activities, it is also useful as a general introduction to the programs of the Laboratory. Additional information on research activities can be obtained by contacting the Laboratory directly.

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NMFS HONOLULU LABORATORY

1997 OVERVIEW

Importance of Central and Western Pacific Fisheries

Fisheries under U.S. jurisdiction in the central and western Pacific are healthy and viable, important, and valuable. The condition of fisheries in the central and western Pacific and Hawaii appears to be the best of all regions for which the NMFS is responsible. However, great care and continued attention must be taken to preserve the healthy state of the fisheries in this immense geographic jurisdiction.

Analysis of pelagic fisheries in the central Pacific shows no signs of overfishing, although some stocks may be near their sustainable yields. The Hawaii swordfish fishery has shown a recovery in CPUE (catch per 1,000 hooks) following a steep decline in 1994. Although swordfish landings have declined because fishing longline effort shifted to tuna in 1995-96, good results were shown in the swordfish component of the longline fishery in the later half of 1996 and during the 1997 season. Longline catch of albacore in American Samoa and Hawaii are both growing significantly. Hawaii's lobster (spiny and slipper) and bottomfish (snappers and groupers) fisheries in the Northwestern Hawaiian Islands (NWHI) are both in good condition, following proactive action by NMFS and the Western Pacific Regional Fishery Management Council (WPRFMC) to assist in the rejuvenation of the NWHI lobster fishery. The Hancock Seamount stocks of deep-sea groundfish (armorhead) have not recovered following overfishing by foreign fishing nations prior to the implementation of the Magnuson Act in 1976. This fishery remains closed by Council action and a long-term moratorium has been proposed.

Several nearshore fisheries in the main Hawaiian Islands and Guam have shown significant stress (e.g., main Hawaiian Islands bottomfish). The Council is considering to what extent these require Federal (as opposed to State and Territorial) attention, since 80% of the MHI fishery and much of the Guam nearshore fishery lie within the territorial sea. Nonetheless, maintaining the overall good condition of these fisheries remains within the fisheries research mission of the Honolulu Laboratory. However, most attention within the Laboratory is applied to the actively managed fisheries: pelagic longline and Northwestern Hawaiian Islands lobster and bottomfish.

Three western Pacific ports: 1) Pago Pago, American Samoa, 2) Agana, Guam, and 3) Honolulu, Hawaii rank in the 10 most valuable U.S. fishing ports when distant-water landings are included (Table 1). The ex-vessel value of marine fish landings in these ports in 1996 was $356 million. The value of these fisheries to these cities is substantial. U.S. canneries are the primary employer in American Samoa, and transshipment is a major source of income for Guam. Fisheries also have high economic impacts in Hawaii.

Beginning in the mid-1980s, Hawaii's annual commercial fishery landings and ex-vessel values have shown progressive increases (Figs. 1 and 2, respectively). During the decade prior

to 1985, annual commercial landings were relatively flat, ranging between 10 million and 15 million pounds. However, during the most recent decade, they increased steadily to a high of nearly 35 million pounds in 1993, followed by a decline in 1994 and rebound in 1995 and 1996. Ex-vessel values ranged between $20 million and $25 million annually during the decade prior to 1985 but climbed steadily to a peak of nearly $85 million in 1993 (the top of the swordfish fishery). Current value is $63 million (1996).

Importance of Central and Western Pacific Marine Mammals and Sea Turtles

The Hawaiian monk seal is the only endangered marine mammal found entirely within U.S. waters. Abundance has declined by 60% since the late 1950s and is currently 1,300-1,400 animals. In recent years, some subpopulations in the NWHI have declined, following a period of recovery, while others have increased. Such increases are largely due to recovery actions designed to enhance population growth.

Sea turtles are designated worldwide as threatened and endangered species. Population declines are especially prominent in the Pacific Islands as the result of nesting habitat loss and excessive, intensive harvesting for commercial, cultural and subsistence purposes. The green turtle population in the Hawaiian Islands has responded favorably over the past two decades to recovery and research efforts by NMFS, the U.S. Fish & Wildlife Service, and the State of Hawaii. However the fibropapilloma disease is a threat that continues to impede recovery of the green turtle populations. At the same time, negative interactions with sea turtle by commercial longline fisheries, including the Hawaii-based domestic fishery, is a new problem. While there have been interactions with a variety of turtle species (loggerheads, olive ridley, leatherbacks and green), they are not viewed as jeopardizing these populations. Nonetheless, fishery management actions are being taken to reduce this interaction.

Improving the recovery conditions of the Hawaiian monk seal and the region's sea turtles is the protected species mission of the Honolulu Laboratory.

Table 1. The Ten Most Valuable U.S. Fishing Ports[1]

Ex-Vessel Values – $ million

Rank[2]	Port[3]	1995	1996
1	**Pago Pago, American Samoa**	**$201.6**	**$211.8**
2	Dutch Harbor, Alaska	146.2	118.7
3	New Bedford, Massachusetts	86.9	100.5
4	**Agana, Guam**	**117.2**	**94.2**
5	Kodiak, Alaska	105.4	82.3
6	Key West, Florida	66.7	62.8
7	Brownsville-Port Isabel, Texas	66.0	60.0
8	**Honolulu, Hawaii**	**46.7**	**50.1**
9	Point Judith, Rhode Island	43.7	46.0
10	Empire-Venice, Louisiana	51.1	45.4

[1]Puerto Rico and some individual ports are excluded because of confidentiality restrictions.

[2]1996 rank.

[3]Data from *Fisheries of the U.S.* (1995, 1996; NMFS), except for Pago Pago and Agana, which were provided by the Western Pacific Regional Fishery Management Council and local landings for American Samoa, Guam, and the Northern Mariana Islands, which were provided by WPacFIN.

[4]Includes U.S. domestic and foreign distant-water landings in American Samoa and Guam.

Figure 1

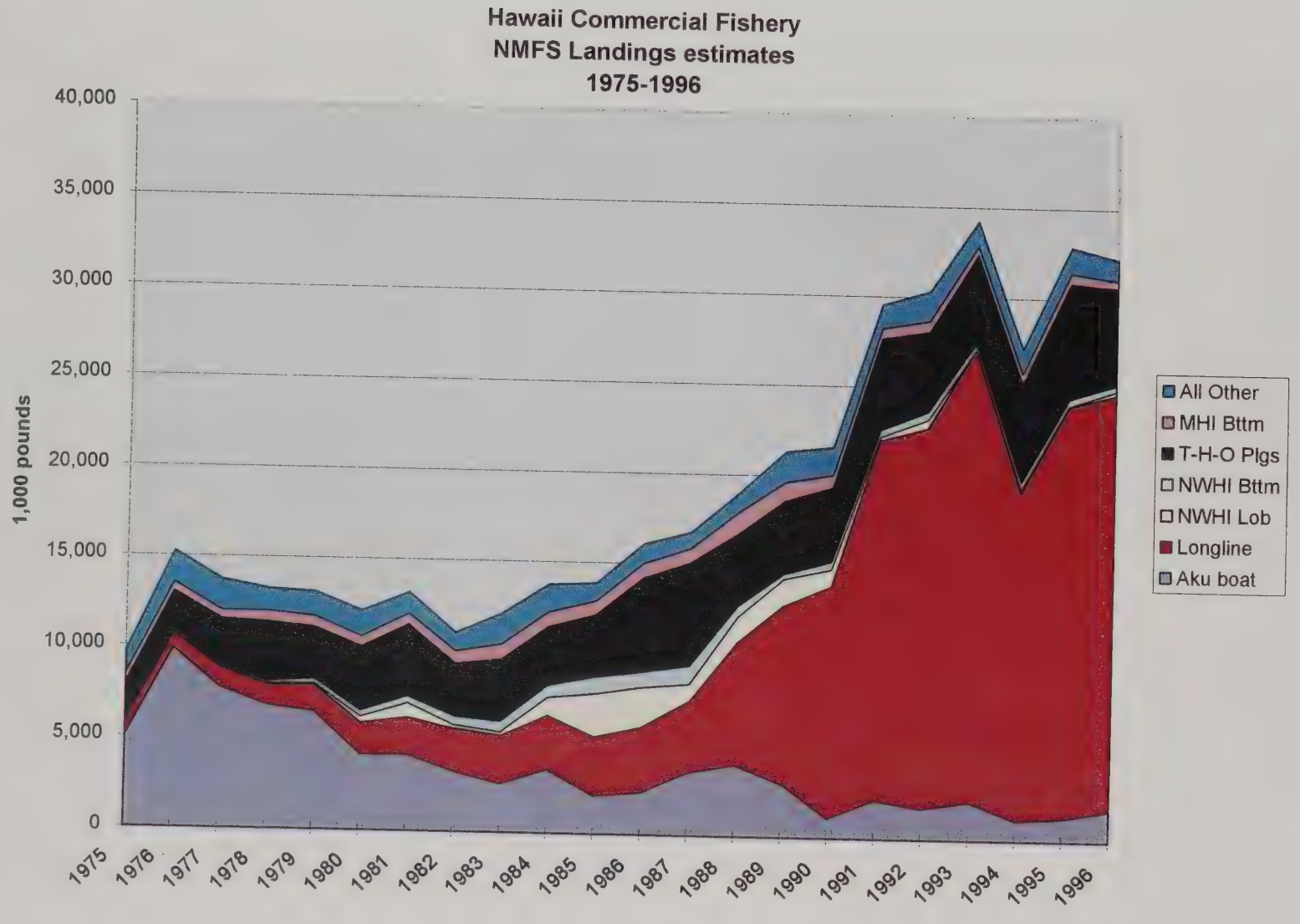
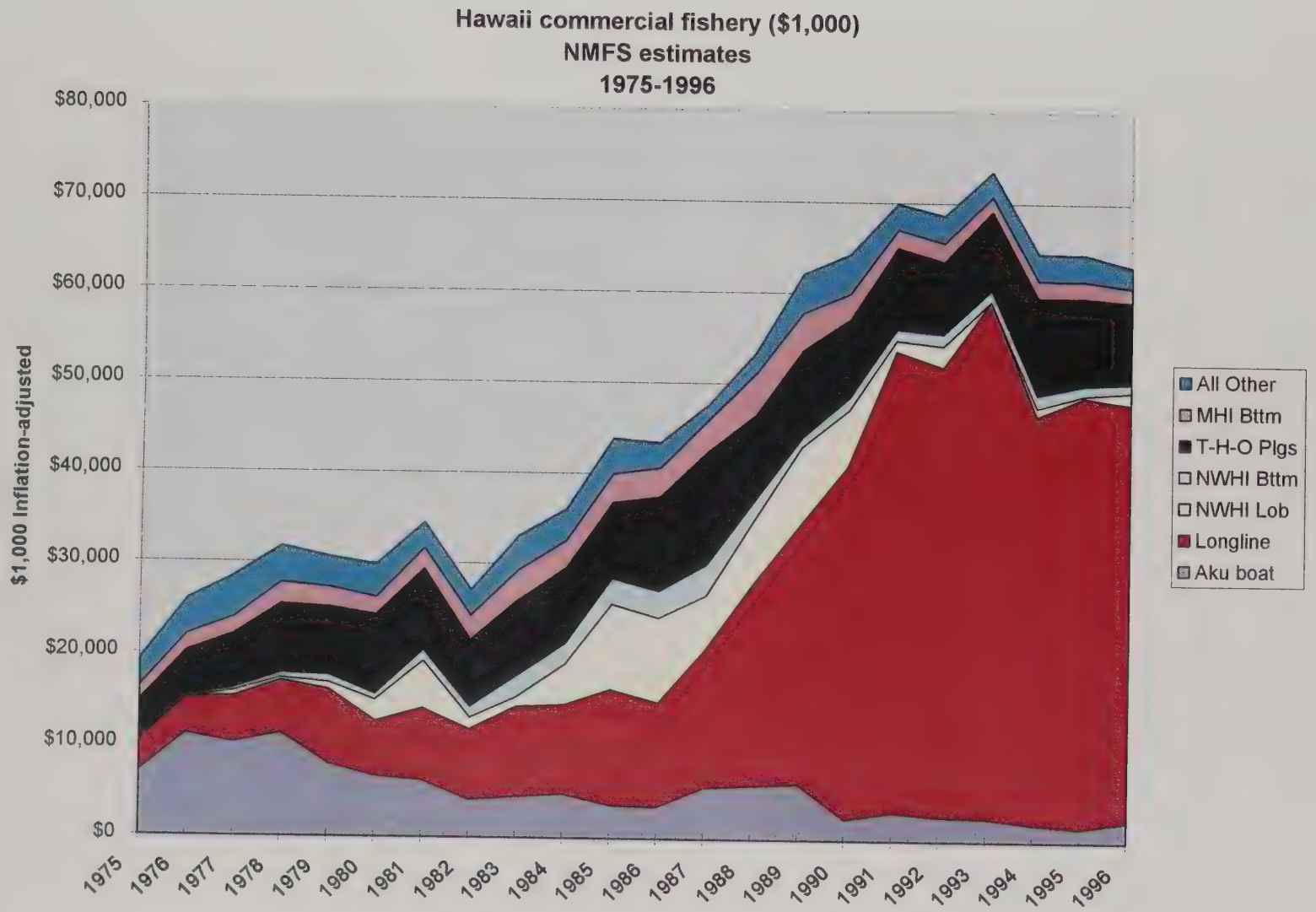

Hawaii Commercial Fishery
NMFS Landings estimates
1975-1996
1,000 pounds
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
All Other
MHI Bttm
T-H-O Plgs
NWHI Bttm
NWHI Lob
Longline
Aku boat

Figure 2


Hawaii commercial fishery ($1,000)
NMFS estimates
1975-1996
$1,000 Inflation-adjusted
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
All Other
MHI Bttm
T-H-O Plgs
NWHI Bttm
NWHI Lob
Longline
Aku boat

THE HONOLULU LABORATORY

The NMFS Honolulu Laboratory will celebrate its Golden Anniversary in 1998. The Laboratory has had an illustrious history during the past 50 years of performing fisheries exploration and development, conducting fisheries research, and providing scientific information and expertise in support of fisheries management and protected species recovery in the central and western Pacific. The following events are being planned by the Laboratory to mark this special occasion:

May 1998 – Session at the Tuna Conference regarding 50 years of tuna research at the Honolulu Laboratory.

September 1998 – Special session at the Eastern Pacific Oceanic Conference (EPOC) on the contributions made by the Laboratory to understanding the oceanography of the Pacific.

Open House aboard the NOAA ship *Townsend Cromwell*

Open House at the Honolulu Laboratory followed by a staff and constituent party at the Waikiki Aquarium

Special presentation at the WPRFMC

Geographic Area of Responsibility

The geographic area of responsibility of the Honolulu Laboratory is the largest of all U.S. fisheries laboratories. The vast area is bounded by the entire Hawaiian Archipelago in the north, American Samoa and U.S. possessions in the south, and the Marianas Archipelago in the west (Fig. 3). The area of these EEZs is over 1.7 million square nautical miles, which is more than the EEZ of the entire U.S. mainland (including Alaska), which is slightly less than 1.6 million square nautical miles.

Mission

The mission of the Honolulu Laboratory is linked to the NOAA Strategic Plan and to the Department of State priorities concerning international fisheries management in the Pacific:

NOAA Strategic Plan

- Build Sustainable Fisheries
- Recover Protected Species

Department of State Priority Issue

- International fisheries management of highly migratory species in the Pacific.

Goals

The goals of the Honolulu Laboratory are to provide scientific information and advice for

- Management of domestic fisheries in the U.S. Exclusive Economic Zones in the central and western Pacific
- Support U.S. interests in international management of highly migratory fish species in the Pacific Ocean
- Recovery and management of the highly endangered Hawaiian monk seal and protected Pacific sea turtles.

Objectives

The objectives of the sustained fisheries efforts at the Laboratory are to

- Provide scientific advice and expertise to NMFS, Department of State, and WPRFMC.
- Conduct biological/ecological research in support of three Fishery Management Plans.
- Conduct economic research on fisheries policy and management alternatives.
- Collect fisheries statistics and monitor status of fisheries

Protected Species Objectives

The objectives of the protected species work at the Laboratory are to

- Monitor and assess population status of the Hawaiian monk seal and the Pacific sea turtle.
- Study ecology, biology, and natural history of protected species.
- Identify and mitigate problems impeding recovery.

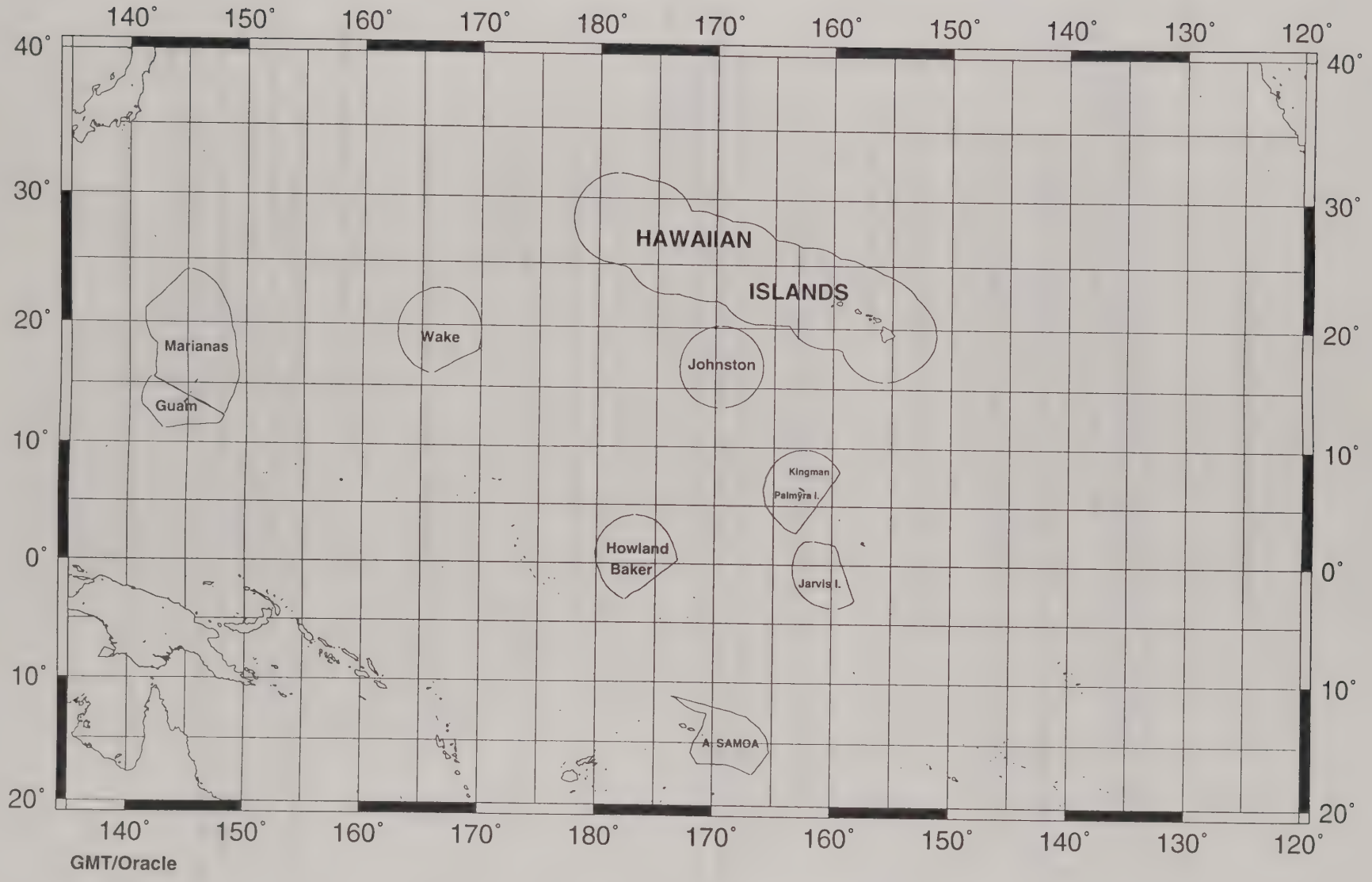


Figure 3. Honolulu Laboratory Area of Responsibility

The Fisheries Research Program

Objectives

The objectives of the Honolulu Laboratory's fisheries research program supporting the NOAA Strategic Plan to Build Sustainable Fisheries and the Department of State priority issue concerning International Fisheries Management include:

- Biological and economic research in support of three Fishery Management Plans
- Biological and economic research in support of international management of Pacific tunas and tuna-like species
- Fisheries oceanography related to marine ecosystems
- Fisheries monitoring

Approach to Fisheries Research and Management in the Western Pacific

In order to not repeat the experience of other regions in collapsing fisheries and the resulting significant negative economic consequences that have occurred in other areas of the U.S., a proactive approach to fisheries research and management must be followed in the western Pacific and Hawaii region. This course of action will:

- Assure sustainability of the fisheries stocks,
- Ensure the viability and health of fisheries industries,
- Provide a significant source of cultural values and recreation to the region's diverse people.

Research in Support of Fishery Management Plans (FMPs)

Pelagic Fisheries of the Western Pacific FMP

This FMP regulates fishing for pelagic species including: tunas, swordfish, marlins, sharks, mahimahi, opah (moonfish), ono (wahoo), and other pelagic species, within the EEZs of U.S.-affiliated islands in the western Pacific. This includes the significant commercial domestic longline, troll, handline, and pole-and-line fisheries operating out of Hawaii, and the recently developing albacore longline fishery operating out of Samoa. The Laboratory provides the following scientific information to the NMFS and the WPRFMC:

- Annual estimates of commercial and recreational pelagic landings.

- Regular stock assessments.
- Economic research

Primary research emphasis is placed on swordfish, where a multidisciplinary framework for identifying, prioritizing, conducting, and coordinating swordfish research is provided by the Swordfish Research Team. Schematics showing the approach and objectives of the swordfish research program are found in Figures 4 and 5, respectively. Research is also conducted to evaluate fisheries interactions among central and western Pacific tuna fisheries and to evaluate the magnitude and fisheries ecosystem impacts of pelagic shark bycatch by the Hawaii-based longline fishery. A listing of pelagic species research needs and status is found in Table 2. Information on catch and catch rates for pelagic species taken in the Hawaii longline fishery are found in Appendix B.

Figure 4

NMFS Honolulu Laboratory Research Program

Addresses Pacific Broadbill Swordfish System

- Swordfish *resource*,
- *Environment* within which it lives,
- *Fisheries* that operate on it, and
- *Interactions and relationships* among these components

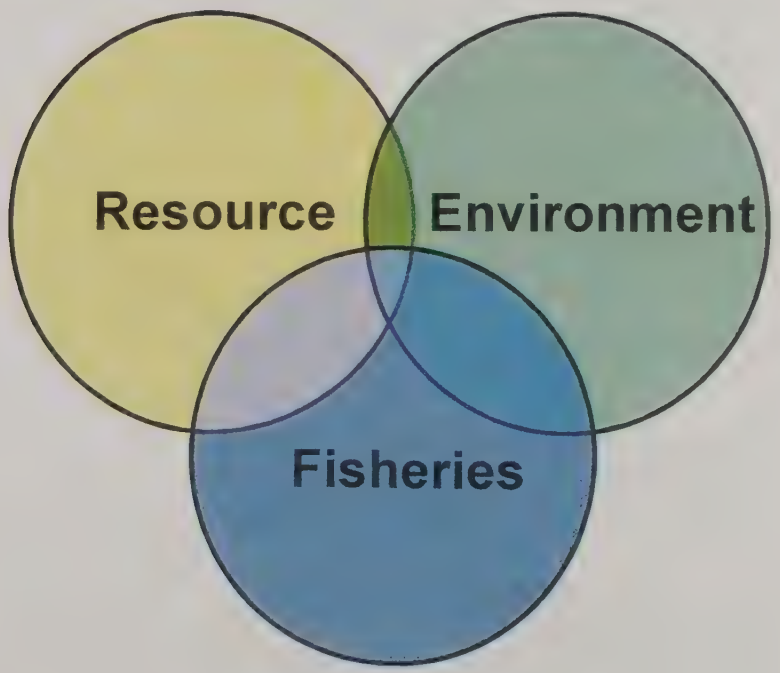


Figure 5

NMFS HONOLULU LABORATORY PACIFIC BROADBILL SWORDFISH RESEARCH OBJECTIVES

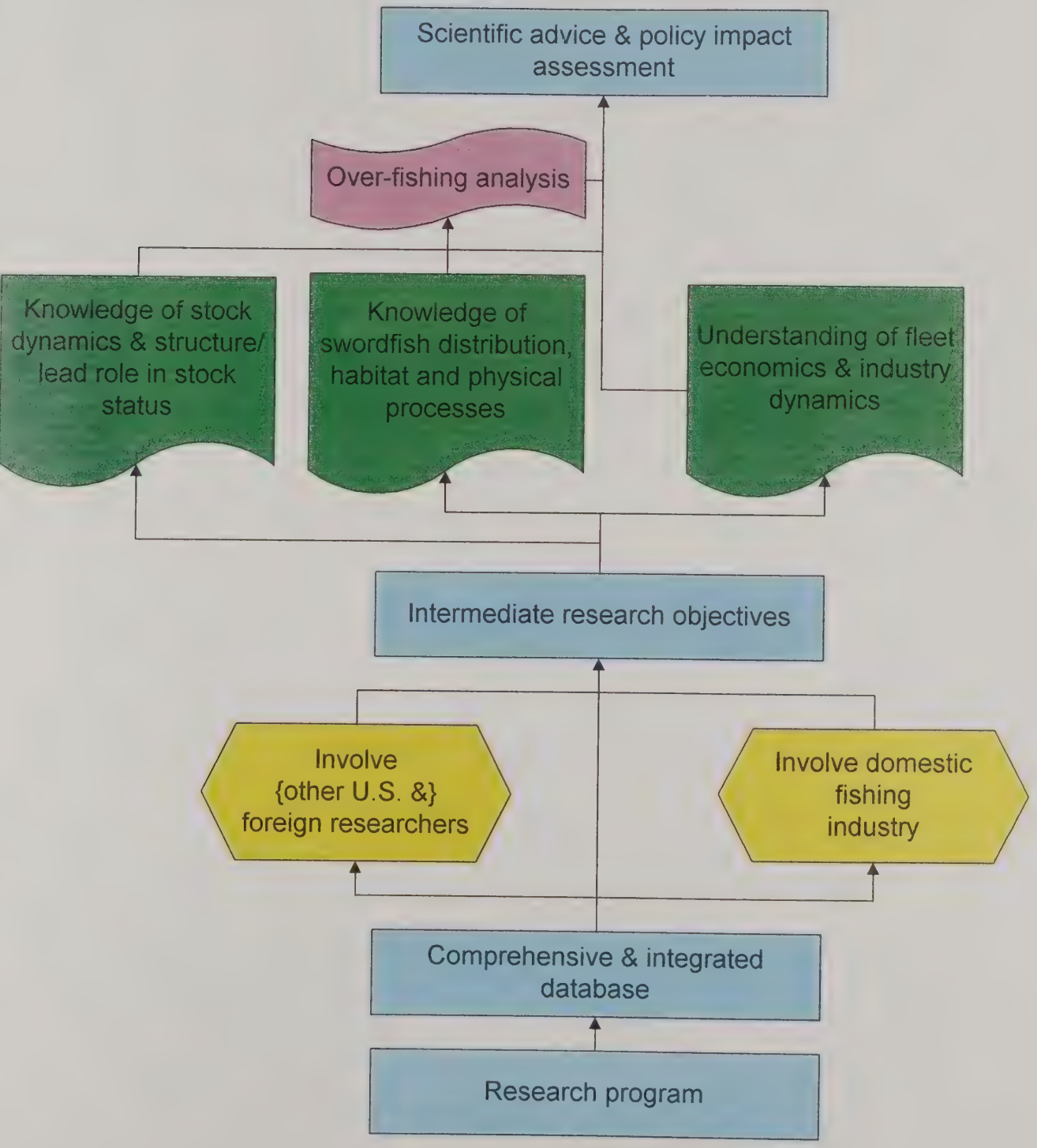

Scientific advice & policy impact assessment
Over-fishing analysis
Knowledge of stock dynamics & structure/ lead role in stock status
Knowledge of swordfish distribution, habitat and physical processes
Understanding of fleet economics & industry dynamics
Intermediate research objectives
Involve {other U.S. &} foreign researchers
Involve domestic fishing industry
Comprehensive & integrated database
Research program

Table 2. Pelagic fisheries species research needs and status, including protected species interactions

Priority	Species	Why Research Needed	Status of Research
Very High	Swordfish	Highly valuable pelagic species in HI; biology, ecology, & stock status largely unknown	Research underway; comprehensive HL research plan developed; lead in ISC
	Shark bycatch	Political issue, impacts of bycatch & discards not known	Monitoring catch, discards & finning; some research, need plan; possible ISC topic
	Sea turtle interactions	Protected species; conservation issue	Monitoring; some research; need improved communication and coordination with SWR
	Seabird interactions	Conservation issue	Make mortality estimates in cooperation with FWS; assist in mitigation
High	Bigeye tuna	Concern stocks becoming overfished; highly valuable pelagic species in HI	Monitoring catch; some HL research, but need plan; ISC identified species, but no plan
	Striped marlin	Pressure to stop sales; political issue, probably no conservation problem; important economically to HI	Monitoring catch, but some ID problems; need research plan; placeholder for marlins in ISC, no sub-committee established
	Blue marlin	Possible conservation issue	Monitoring catch; see above regarding ID problem and ISC
Medium	Mahimahi	2nd most abundant species in Hawaii; stock status unknown	Monitoring catch; some research, but stock status needed
	North Pacific albacore	Expansion to major component in catch of HI fisheries	Monitoring catch; cooperate with LJ in status of stock; may require HL research in future
	Opah (Moonfish)	Increasing importance in HI catch; stock status, biology, & ecology unknown	Monitoring catch; possible future research
	Yellowfin tuna	Perceived fisheries interactions; stocks appear OK in Pacific	Monitoring catch; JIMAR research shows no interactions; may need more research
Low	Skipjack tuna	New HI aku pole & line vessel built; new fresh market in Japan; stocks OK	Monitoring catch; may require some economic analyses
	Ono	Moderate importance in HI fisheries; bycatch in central and western Pacific	Monitoring catch; JIMAR ageing study; no HL research planned

Crustacean Fisheries FMP of the Western Pacific

The Northwestern Hawaiian Islands (Fig. 6) trap fishery for spiny and slipper lobsters is managed under this FMP. The Honolulu Laboratory provides the NMFS SWR and WPRFMC

- Annual harvest guideline for the fishery
- Annual stock assessment
- Scientific advice and economic analyses for managing the fishery.

Laboratory scientists recently developed new methodology for determining the annual harvest guideline, annually assess stock status, conduct research on lobster recruitment and handling mortality, and perform economic analyses for evaluating alternative management actions. NWHI lobster stocks are rebuilding following an apparent recruitment failure in the late 1980s and early 1990s (see Appendix D).

Bottomfish and Seamount Groundfish Fisheries FMP of the Western Pacific

Snapper, grouper, and jack species in American Samoa, Guam, Hawaii, and the Commonwealth of the Northern Mariana Islands (CNMI) are managed under this FMP. In addition, this FMP includes provisions for management of the Hancock Seamount armorhead resource.

In Hawaii, two bottomfish zones in the NWHI are regulated by the FMP: one zone has limited entry and other zone requires a permit, but does not, as yet, have limited entry. The WPRFMC, with the assistance of Laboratory and JIMAR economists, is currently assessing options for regulating the open access area. The Laboratory is also assisting the WPRFMC in evaluating alternative management actions which may be implemented if the State of Hawaii's actions regarding overfishing of certain bottomfish stocks in the MHI prove to be inadequate to address overfishing. The Hancock Seamount armorhead fishery is closed to harvest, apparently due to overfishing by foreign fleets prior to the establishment of the FMP. The second of two 6-year moratoriums will expire on August 31, 1998, and the WPRFMC has decided to apply for a continued closure.

The Honolulu Laboratory provides the NMFS SWR, and WPRFMC with the following:

- Information on the status of stocks and fisheries for MHI and NWHI bottomfish
- Economic analyses and evaluations of management
- Information on the status of the Hancock Seamount armorhead stocks
- Information on landings in the flag state bottomfish fisheries

Honolulu Laboratory scientists primarily evaluate fishery and economic data to determine the health of the stocks and fisheries for bottomfish. Bottomfish stocks in the NWHI covered by the FMP appear to be healthy, but several species in the MHI, which are under State of Hawaii management jurisdiction, are recruitment overfished. Information on the status of the Hancock Seamount armorhead and bottomfish stocks are found in Appendix E.

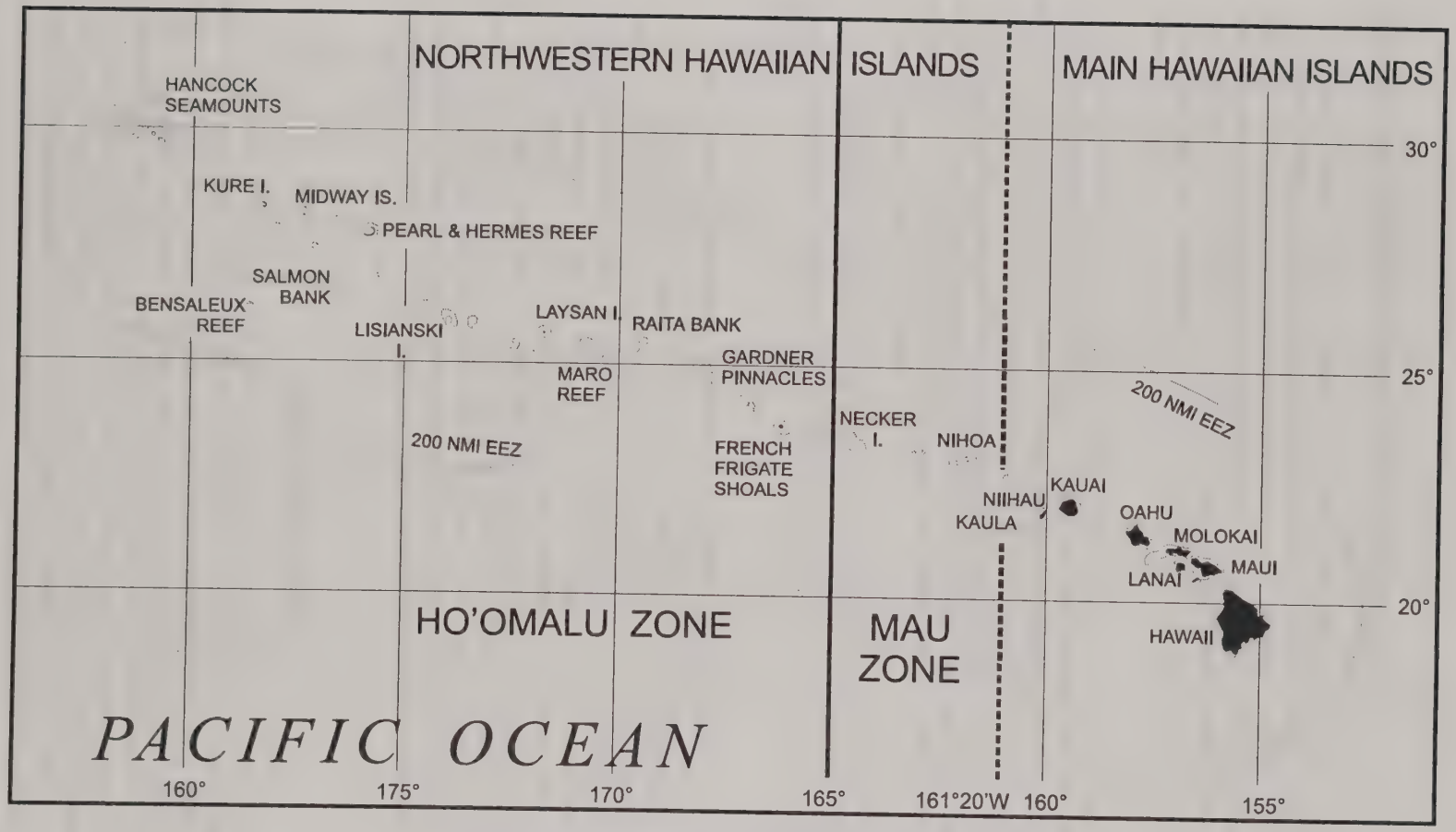


Figure 6. Northwestern Hawaiian Islands Zones

Research in Support of International Fisheries Management

The mission of the Honolulu Laboratory has been expanded to include support for international management of highly migratory species in the Pacific. This has come about in response to several recent international fisheries agreements, notably the Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific (ISC), the new highly migratory species fisheries management organization that is under development in the southwest Pacific; U.N. Agreement on Straddling and Highly Migratory Stocks, and the High-Seas Fisheries Compliance Act.

The objective of the Laboratory's efforts is to provide scientific advice and information to NMFS for supporting Department of State actions concerning the international management of tuna and tuna-like species in the Pacific. The Laboratory is playing a key role in the ISC, including leading cooperative international research on North Pacific swordfish and hosting an international swordfish symposium in March 1997. Since bigeye tuna and marlins are important in Hawaii-based fisheries, the Laboratory intends to be an active participant in research efforts related to these species as ISC programs on them are developed, as well as the ISC project concerning data needs on Pacific highly migratory species.

The Honolulu Laboratory will also be involved in the former western Pacific Yellowfin Working Group that has recently been expanded to include other species for highly migratory fishes.

Fisheries Oceanography Research Related to Marine Ecosystems

The goal of this research program is to develop understanding required to differentiate between variations in stocks of marine fishes and populations of protected species caused by natural fluctuations in marine environmental conditions from those caused by man–harvesting, pollution, loss of habitat, etc. Specifically, the program seeks to advance understanding of marine ecosystem dynamics with particular focus on the dynamics of the Northwestern Hawaiian Islands and Pacific pelagic ecosystems. The approach being followed involves the use of biological and physical data from research cruises, fisheries logbooks, ocean circulation models, and satellites to describe physical and biological dynamics and their links for NWHI and Pacific pelagic ecosystems. Primary research funding during the past year is discussed in Appendix C2. Results from this research program have applications in research dealing with swordfish, NWHI lobsters, and Hawaiian monk seals.

Fisheries Monitoring

Fisheries monitoring operations are critical for providing scientific advice to meet the Laboratory's mission. These operations involve three programs: fisheries statistics obtained from Federal logbooks and shoreside monitoring of the Hawaii-based longline and lobster fisheries; a similar program coordinated with the NMFS SWR for the American Samoa longline fishery; and the Western Pacific Information Network (WPacFIN) which compiles State and territorial fisheries agency data. Laboratory investigators gather, process, and manage databases from the Hawaii longline and lobster fisheries, Hawaii fish auctions, and various market sampling operations. WPacFIN is a cooperative Federal-State program between NMFS and the four U.S.-associated Pacific Island entities that compile fisheries statistics from the island areas. The central WPacFIN

site is located at the Honolulu Laboratory, which serves as the central database and the source of technical assistance in survey design and implementation, computer programming and statistical techniques, and data base management. Additional information on Fishery Monitoring is found in Appendix F.

The Protected Species Research and Recovery Program

Objectives

The Honolulu Laboratory has two research programs supporting the NOAA Strategic Plan to Recover Protected Species–Hawaiian monk seal and Pacific sea turtles. In addition, the Laboratory is cooperating with the U.S. Fish and Wildlife Service concerning fisheries interactions with seabirds.

The objectives of the Hawaiian monk seal recovery program include the following:

- Determine population status at main monk seal breeding sites.
- Identify and mitigate problems impeding population recovery.
- Conduct rehabilitation and relocation operations.
- Mitigate mobbing and its impact on population growth.
- Investigate pelagic ecology.
- Reduce entanglement by marine debris.
- Make recommendations for recovery and management
- Coordinate and cooperate in intra- and inter-agency recovery efforts

The objectives of the Pacific sea turtle recovery program include the following:

- Study biology, ecology, and natural history of Pacific sea turtles, with emphasis on the Hawaiian green sea turtle.
- Conduct research in support of the NMFS Biological Opinion concerning interactions between the Hawaii-based longline fishery and sea turtles.
- Develop models for assessing status of Pacific sea turtle populations.
- Investigate fibropapilloma disease epidemic in green sea turtles.
- Provide technical assistance and training in the Pacific region to promote collections of reliable data on sea turtles.

The status and main activities conducted by the Hawaiian Monk Seal and Pacific Sea Turtle Programs are found in Appendixes H, and I, respectively.

The objective of the cooperative efforts with the U.S. Fish and Wildlife concerning fisheries interactions with seabirds is to investigate seabird mortality caused by longline fishing operations and to make estimates of seabird mortality using data from longline logbook and SWR sea turtle observer records. Further information can be found in Appendix J.

HONOLULU LABORATORY BUDGET, STAFFING, AND ORGANIZATION

Honolulu Laboratory FY 1997 Budget

The FY 1997 budget for the Honolulu Laboratory is approximately $7 million. NMFS base funds allocated to the Laboratory by the SWFSC cover $3.3. million of this budget. The balance comes from several sources including NMFS add-on funds from F/PR, SWR, and Saltonstall-Kennedy (SK) amounting to about $1.5 million; Congressional PPAs totaling about $1.1 million; NOAA/NESDIS, nearly $0.3 million; and Hawaii fishery development funds that were not awarded to the Oceanic Institute (OI), approximately $0.7 million. A summary of the budget by funding source and selected programs is provided in Table 3.

Table 3. Honolulu Laboratory FY 1997 Budget

Funding Source	Amount ($1,000)
NMFS base	$3,321.2
NMFS add-on	
Monk seal	875.0[a]
Sea turtle	374.2
WPacFIN	74.0
SWR support for PAO	46.6
SK lobster	18.0
SK monk seal	153.3
GIS from SWR	6.5
PPA	
Monk seal	501.7
Sea turtle	227.2
Swordfish	368.8
Other Funding	
Coastwatch (NESDIS)	153.9
Satellite/Fisheries Applications (NGSDIS)	75.0
Ocean Color (NESDIS)	60.0
Non-Award OI Funds	
HI Fish Dev c/o Hon	706.0
TOTAL	$7,061.0

[a]Includes $600K prepaid by F/PR in FY 1996, $50K provided by the NMFS Deputy Director for upgrades to the Kewalo Research Facility, and $45K provided by F/PR for a meeting of experts on captive care.

Honolulu Laboratory NOAA and UH/JIMAR Staff

The staff at the Honolulu Laboratory includes 54 NOAA/NMFS, 1 NOAA Corps officer (two officer billets are scheduled in FY 98), and 57 NOAA/UH Joint Institute for Marine and Atmospheric Research (JIMAR). Most of the UH/JIMAR staff members are funded by grants awarded by the Laboratory to the UH/JIMAR. Some of the UH/JIMAR staff members are supported from research proposals awarded competitively to Laboratory scientists by the JIMAR Pelagic Fisheries Research Program (PFRP) (see section **Honolulu Laboratory Relationships with the University of Hawaii** for further discussion). Thirty UH/JIMAR staff members are full-time, and 27 are part-time or seasonal hires. The number of staff members by category appears in Table 4.

Table 4. Honolulu Laboratory NOAA and UH/JIMAR Staff

Organization	Number
NOAA	
NMFS	54
NOAA Corps	1
Total NOAA	55
UH/RCUH - JIMAR Staff	
Administration Staff	2
Fishery Oceanography	12
WestPacFIN	7
CoastWatch	2
MARDAP	3
Pelagic Fishery Research Program	7
Full-time	30
Part-time	12
Seasonal hires	15
Total non-NOAA	57
TOTAL	112

Honolulu Laboratory Organization

The Laboratory is organized into the Laboratory Director's office, five research investigations (Fish Biology and Ecology; Ecosystems and Environment; Stock Assessment; Fishery Management and Performance; and Protected Species), and three other offices--Director's Office, Administrative Services, and Scientific Information and Technical Services. The latter group also includes the NOAA CoastWatch Site. An organization chart for the Laboratory is given in Figure 6: listing of staff by Investigation or program is given in Table 6.

Research Investigations and Research Teams

Program management at the Honolulu Laboratory follows a hybrid form of matrix management, with extensive interactions across five research investigations, which are organized on a functional basis.

The five research investigations and their subprograms include:

(1) Fish Biology & Ecology Investigations
- Fish Biology program
- Life History program
- Fish Ecology program

(2) Ecosystem and Environment Investigation
- Fisheries Oceanography program
- Ecosystem and Habitat program

(3) Stock Assessment Investigation

(4) Fishery Management & Performance Investigation
- Fishery Monitoring and Economics program
- Fishery Data Management program
- Western Pacific Fishery Information Network program

(5) Protected Species Investigation
- Marine Mammal Research program
- Marine Turtle Research program

Director's Office and Administration

The primary objectives of the Director's Office are to provide overall scientific leadership and research direction, program management, and operational policy. In addition, the office is responsible for liaison with other NMFS and NOAA offices, WPRFMC, University of Hawaii, State of Hawaii, and other agencies and organizations.

The Administration group provides comprehensive administrative services for procurement, budget planning and implementation, fiscal monitoring, personnel management, travel, facilities management, and scientific editorial and illustration services for the Honolulu Laboratory.

Scientific Information and Technical Support Services

The objectives of this group are to provide scientific and technical support for the Honolulu Laboratory and the SWR Pacific Area Office as well, including:

- Computer hardware and software systems,
- Communications systems, e.g., Laboratory LAN, agency WAN, and data communication networks linked with the UH and NWS
- Computer and communication systems security
- Administration and computer programming assistance for Oracle
- Library services
- NOAA CoastWatch operations

Figure 7

HONOLULU LABORATORY ORGANIZATION CHART

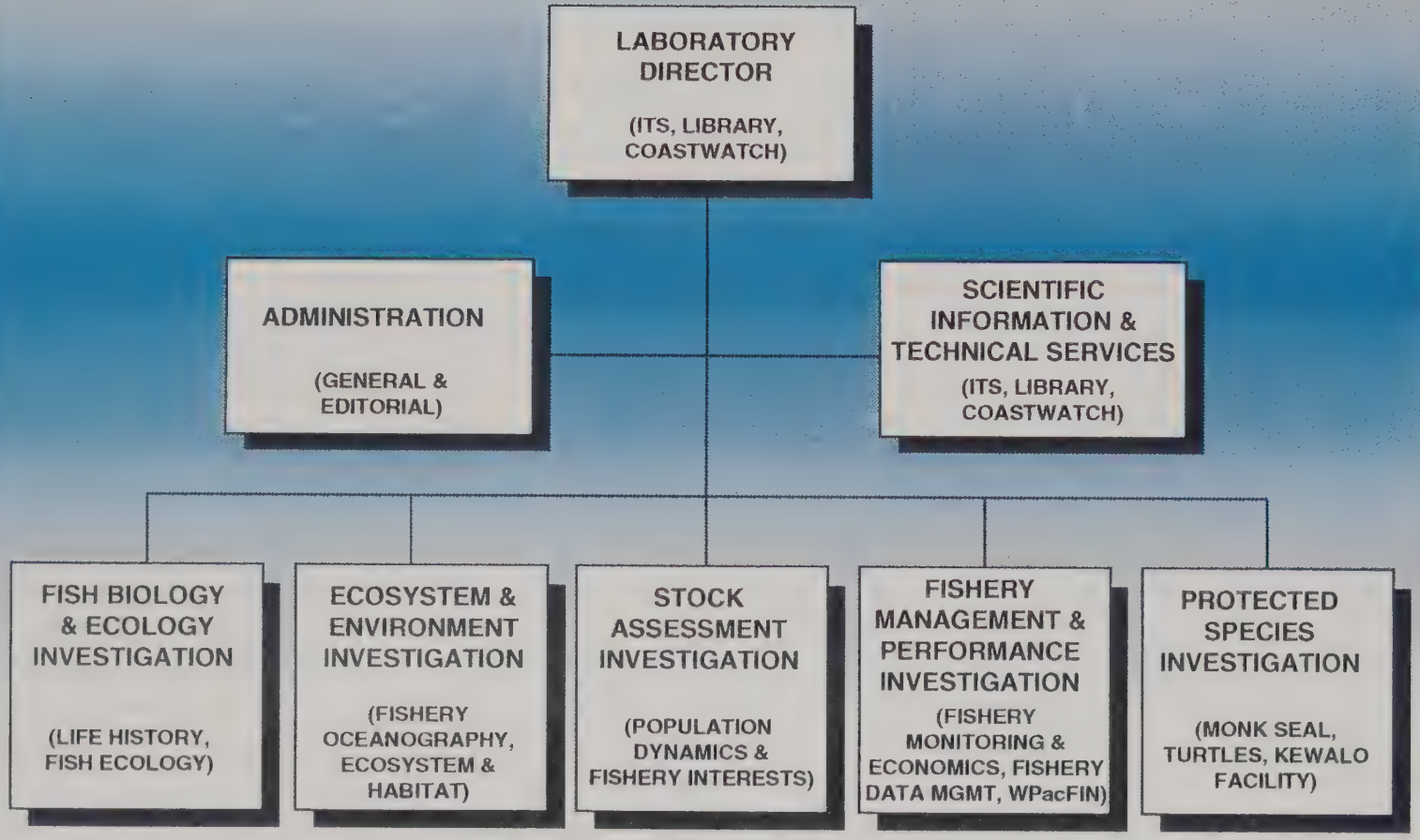

LABORATORY DIRECTOR
(ITS, LIBRARY, COASTWATCH)
ADMINISTRATION
(GENERAL & EDITORIAL)
SCIENTIFIC INFORMATION & TECHNICAL SERVICES
(ITS, LIBRARY, COASTWATCH)
FISH BIOLOGY & ECOLOGY INVESTIGATION
(LIFE HISTORY, FISH ECOLOGY)
ECOSYSTEM & ENVIRONMENT INVESTIGATION
(FISHERY OCEANOGRAPHY, ECOSYSTEM & HABITAT)
STOCK ASSESSMENT INVESTIGATION
(POPULATION DYNAMICS & FISHERY INTERESTS)
FISHERY MANAGEMENT & PERFORMANCE INVESTIGATION
(FISHERY MONITORING & ECONOMICS, FISHERY DATA MGMT, WPacFIN)
PROTECTED SPECIES INVESTIGATION
(MONK SEAL, TURTLES, KEWALO FACILITY)

Table 5. Personnel, Honolulu Laboratory

DIRECTOR'S OFFICE
R. M. Laurs, Supvy. Oceanographer
L. Onosaki, Program Support Asst.
D. Foley, CoastWatch Coordinator*
E. Howell, Research Associate*

ADMINISTRATION
S. Kamei, Administrative Officer
F. Fiust, Editorial Clerk
J. Kendig, Writer/Editor
J. Tamanaha, Purchasing Clerk
G. Wong, Admin. Support Asst.
S. Wong, Budget Assistant
D. Yamaguchi, Scientific Illustrator
H. Gerboc, General Maintenance Asst.*
C. Kohan, Admin. Support Specialist*
R. Orias, Student (P/T)*
S. Yamamoto, Student (P/T)*

SCIENTIFIC INFORMATION & TECHNICAL SERVICES
D. Tieman, Supvy. Comp. Sys. Analy.
S. Abbott-Stout, Librarian
W. Higuchi, Computer Specialist
J. Pappas, Computer Specialist
R. Price, Computer Specialist
R. Uyeda, Computer Specialist
R. Yoshimoto, Computer Assistant

FISH BIOLOGY & ECOLOGY INVESTIGATION
C. Boggs, Fishery Biologist
R. Chang, Fishery Biologist
E. DeMartini, Fishery Biologist
R. Humphreys, Fishery Biologist
T. Kazama, Fishery Biologist
R. Moffitt, Fishery Biologist
B. Mundy, Fishery Biologist
R. Nishimoto, Fishery Biologist
J. Sampaga, Bio. Sci. Tech. (Micro)
P. Shiota, Fishery Biologist
J. Uchiyama, Fishery Biologist
H. Williams, Bio. Sci. Tech. (Micro)
D. Curran, Fishery Biologist*
M. Musyl, Fishery Oceanographer*

ECOSYSTEM & ENVIRONMENT INVESTIGATION
J. Polovina, Supvy. Math. Stat.
D. Kobayashi, Fishery Biologist
F. Parrish, Fishery Biologist
M. Seki, Fishery Biologist
K. Tata, Research Associate (P/T)*

STOCK ASSESSMENT INVESTIGATION
J. Wetherall, Supvy. Fishery Biologist
G. DiNardo, Fishery Biologist
P. Kleiber, Fishery Biologist
R. Skillman, Fishery Biologist
J. Dane, Computer Specialist*
W. Haight, Fishery Res. Spec.*
W. Walsh, Asst. Researcher*
T. Yan, Computer Specialist*
Z. Zhu, Student (P/T)*

FISHERY MANAGEMENT & PERFORMANCE INVESTIGATION
S. Pooley, Supvy. Industry Economist
F. Cabacungan, Computer Specialist
F. Dowdell, Computer Specialist
D. Hamm, Supvy. Comp. Spec.
R. Ito, Fishery Biologist
K. Kawamoto, Fishery Biologist
B. Kikkawa, Fishery Biologist
B. Miyamoto, Computer Specialist
M. Quach, Computer Specialist
D. Tagami, Operations Research Analyst
L. Tsukano, Computer Assistant
A. Carlos, Student (P/T)*
N. Chan, Student (P/T)*
M. Ching, Computer Specialist*
D. Gonzales, Computer Specialist*
C. Graham, Computer Specialist*
M. Hamilton, Research Associate*
K. Lu, Student (P/T)*
W. Machado, Fishery Assistant*
J. Pitko, Computer Specialist*
P. Tao, Computer Specialist*
C. Tokita, Data Processing Clerk*
M. Travis, Research Associate*

PROTECTED SPECIES INVESTIGATION
G. Antonelis, Supvy. Wildlife Biologist
G. Balazs, Zoologist
B. Becker, Wildlife Biologist
R. Dollar, Bio. Sci. Tech.
J. Henderson, Fishery Biologist
T. Johanos-Kam, Wildlife Biologist
T. Ragen, Fishery Biologist
J. Sisson, Wildlife Biologist
A. Aguirre, Epidemiologist*
S. Bloom, Student (P/T)*
R. Boland, Biological Technician*
T. Casserley, Student (P/T)*
R. Castillo, Student (P/T)*
M. Craig, Research Associate*
S. Eames, Student (P/T)*
D. Ellis, Research Associate*
L. Keith, Biological Research Technician (P/T)*
S. Murakawa, Research Associate*
A. Pairis, Biological Assistant*
M. Shaw, Biological Research Technician*
A. Sloan, Biological Assistant*
H. Swensen, Computer Specialist*
C. Yoshinaga, Biological Technician*
Vacant, Biological Technician*

*JIMAR employees

Teams

Teams are used to plan, conduct, and coordinate research projects, as well as to ensure communications among all the parties involved. The Teams are made up of individuals from several or all of the Laboratory research investigations and service support groups. A heavy emphasis is placed on team-building training, which is provided by a consultant on contract.

The Laboratory's teams include:

(1) Investigation Chiefs Team
(2) Swordfish Research Team
(3) Oracle Development Team
(4) Lobster Research Team.

Investigation Chiefs Team–This Team consists of the Laboratory Director, Chiefs of the five research investigations, the Administrative Officer, the head of Scientific Information and Technical Services, and the Director's program support assistant. The purpose of this Team is to serve as a board of directors for the Laboratory, to develop policy, to promote open communication among the operating units of the Laboratory, and to coordinate actions among the various groups as needed. A copy of the mission statement of the Team is found in Appendix N.

Swordfish Research Team–The goal of the Swordfish Research Team is to provide an operational multidisciplinary framework for identifying, prioritizing, conducting, and coordinating swordfish research. In recognition of the needs of NMFS, WPRFMC, and ISC for scientific information on swordfish, the Honolulu Laboratory initiated internal interactive planning to identify major objectives and activities for Pacific swordfish research. A comprehensive research plan encompassing fishery monitoring, stock assessment, and biological and fishery oceanography research was developed. The team approach was selected to implement the research because of the diverse nature of the research identified in the plan. The Swordfish Research Team is multidisciplinary and hierarchically structured and consists of two integrated levels: an oversight and planning level and a research operations level. The Team is comprised of scientists and managers from the Honolulu Laboratory, WPRFMC, and UH/JIMAR. Swordfish research is conducted by five working groups, including:

(1) Fleet Dynamics and Economics
(2) Population Modeling and Assessment
(3) Reproduction, Age and Growth
(4) Ecosystem and Environment
(5) Monitoring, Sampling, and Data

Oracle Database Development Team–The Oracle Database Development Team was established to ensure the coordinated conversion of Hawaiian monk seal, Pacific sea turtle, and pelagic fisheries data, as well as other fisheries and related data in the future, within the Honolulu Laboratory Oracle database system. The Team consists of three working groups:

(1) Oracle Monk Seal Development Working Group
(2) Oracle Pelagic Development Working Group
(3) Oracle Turtle Development Working Group

The Oracle Working Groups are composed of scientists who are specialists relative to their specific Working Group and Oracle database or related computer specialists. The Oracle Database Conversion Team coordinator, Working Group Leaders, and Oracle database administrator are responsible for the technical decisions regarding the structure of the database and for the communication and coordination among the various Working Groups. Each Working Groups is responsible for the conversion of databases associated with the respective Group to the Oracle database system. The Team coordinator is responsible for communications and coordination with the Oracle database conversion efforts at the SWFSC in La Jolla and the SWR. Information regarding the Oracle Database Conversion and the mission statement for the Oracle Team are found in Appendixes L and N, respectively.

Lobster Research Team–The Lobster Research Team was formed in response to the need to develop new methods for determining the annual harvest guideline (quota) for the NWHI lobster fishery, for the efforts related to Amendment 9, and for research planning. The Team consists of scientists from the Honolulu Laboratory, UH/JIMAR, NMFS/SWR, and the WPRFMC. Presently, the Team is primarily responsible for appraising the new harvest guideline procedures, lobster research planning, coordinating research activities, and advising the Laboratory Director on lobster research needs.

NOAA CoastWatch

The NOAA CoastWatch Site, which is funded by a contract with NOAA/NESDIS, is located at the Honolulu Laboratory. The Site has direct readout of NOAA satellites (shared with NOAA/NWS) and satellite image processing systems. Satellite-derived ocean temperature data products are produced at the CoastWatch site for distribution to Federal, state, and local agency and university researchers involved in marine science, policy, and management. CoastWatch data products are increasing in use in Honolulu Laboratory fisheries and protected species research. Over the next year, there will be a significant expansion in the amount of satellite information available from the CoastWatch Site, including ocean wind stress and ocean color.

Honolulu Laboratory Relationships with the University of Hawaii

The Honolulu Laboratory is located on the University of Hawaii (UH) Manoa campus. It has extensive relations with the University, resulting in significant mutual benefits. Several of the Laboratory's senior investigators hold UH adjunct professorship or senior research fellow positions, lecture UH courses in marine science and related topics, and serve as scientific advisers to undergraduate and graduate students. UH students serve as a source of talented and motivated temporary help for the Laboratory. The Laboratory computer Internet access and other computer

communications are handled through the UH Computer Center and the NOAA ship assigned to the Laboratory, *Townsend Cromwell*, is berthed and receives port support from the UH. The UH also provides some environmental compliance maintenance for the Laboratory as well as after-hours security. Most direct associations between the Laboratory and the UH are through the NOAA/UH Joint Institute for Marine and Atmospheric Research (JIMAR).

Joint Institute for Marine and Atmospheric Research (UH/JIMAR)

The Laboratory has many interactions with the UH/JIMAR including the opportunity for Laboratory scientists to compete for pelagic fisheries research funding that is awarded competitively by the JIMAR/PFRP. The JIMAR/PFRP administers funding received from a Congressional funding. Laboratory scientists have successfully competed for JIMAR pelagic fisheries research funds and over the past 5 years have served as Principal or Co-Principal Investigators on nine projects totaling $1.9 million. In addition, substantial complementary, collaborative, and cooperative research on pelagic fisheries is conducted by Laboratory and UH/JIMAR scientists.

The Laboratory utilizes the NOAA/UH Joint Institute program by awarding grants to JIMAR for research in support of the mission of the Laboratory. In FY 1997 the Laboratory awarded a grant totaling nearly $1.36 million to JIMAR to support research and operations at the Laboratory. A summary of the funding by projects is provided in Table 6. The Laboratory also participates in the JIMAR visiting scientist program.

Table 6. Honolulu Laboratory Funds Awarded to UH/JIMAR in FY 1997 ($1,000)

Task I	Program Management		$114
Task II	Fishery Oceanography		415
	Pacific Swordfish Research	203	
	Recovery of Hawaiian Monk Seal	116	
	Pacific Sea Turtle Biology and Ecology	96	
Task II	Application of Satellite Remote Sensing to Pacific Highly Migratory Species		55
Task II	Western Pacific Fishery Information Network Project		134
Task II	Marine Resource Dynamics and Assessment Program (MARDAP)		525
	Sea Turtle Assessment and Monitoring	84	
	Sea Turtle Recovery Efforts in Central and Western Pacific*	112	
	Research Support	122	
	Geographic Information System for Fisheries Database System	142	
	Investigation of Pelagic Shark Biology and Incidental Catch by the Hawaii-based Domestic Longline Fishery	65	
Task II	NOAA Hawaii Regional CoastWatch Site		117
	CoastWatch Operations	67	
	NOAA Ocean Color	50	
Total			$1,360

*SWR/PAO project

Significant Accomplishments, Fiscal Year 1997

The most significant accomplishments made by the Laboratory are grouped into topical categories and highlighted below.

Research in Support of Fishery Management Plans

Pelagics

- Logbook and observer records are being used to successfully monitor incidental catch and finning of sharks by the Hawaii longline fishery; studies have been initiated on blue shark ecology, population dynamics, and impacts of fishery on blue shark stock(s).

- Extensive background work completed and RFB issued for prototype "pop-up" satellite transmitting electronic archival tag for use in research on swordfish and other large pelagic fishes.

- Western Pacific pelagics fisheries module prepared for WPRFMC annual report.

NWHI Lobster

- High praise received by the Laboratory from the WPRFMC and industry representatives for research and successful activities related to the 1997 NWHI lobster fishery.

- Stock assessment indicates that NWHI spiny lobster stock in good condition.

Bottomfish

- Recommendations made to the WPRFMC on the optimal number of fishing vessels for the *Ho'omalu* limited-entry fishing zone in the NWHI based on economic and population dynamics information.

- Stock assessments indicate that NWHI bottomfish stocks in good condition; MHI bottom stocks appear to be recruitment overfished.

Research in Support of International Management of Pacific Highly Migratory Species

- Hosted Second International Symposium on Pacific Swordfish

- Hosted meeting of the Interim Scientific Committee Swordfish Working Group.

- Fruitful informal discussions held with Japanese fisheries scientists regarding cooperative development of simulation models for Pacific swordfish and blue shark populations in the North Pacific.

Fishery Oceanography, Ecosystem and Habitat Research

- Annual swordfish fishing success linked to an oceanographic index of the strength of the North Pacific Subtropical Front that was developed using oceanic satellite altimetry.

- Geographic differences in spiny lobster recruitment in the NWHI shown to be related to ocean circulation patterns by simulation studies using satellite altimetry measurements.

- Automated procedures developed for estimating ocean circulation patterns from satellite altimeter data; analyses performed, and charts showing mesoscale ocean circulation patterns transmitted to the NOAA ship *Townsend Cromwell* at sea to guide fishery oceanography research operations.

- Results from fishery oceanography research cruise documented that the oceanographic features associated with the North Pacific Transition Zone and Subtropical Front were displaced southwards about three degrees of latitude in 1997 from their positions in 1996. These changes in the oceanographic environment resulted in shifts in fishing success for highly migratory species and appear to have set up conditions for increased longline fishery interactions with loggerhead sea turtles.

Economics Research

- Sequence of papers on corporate and community approaches to fishery management published in collaboration with University of Maine economist.

- Substantial progress made (in collaboration with UH/JIMAR) in collection of cost-earnings information for several components of the Hawaii commercial small vessel and charter boat fleets.

Fishery Monitoring and WPacFIN

- Significant progress made by WPacFIN in support for Island agencies, WPRFMC plan teams, and WPRFMC requirements.

- Framework developed for WPacFIN website for users to access fisheries statistics and reports..

- Initiated quarterly reports for the new American Samoa longline fishery.

Recovery of Hawaiian Monk Seal

- Field studies required for population assessment and related research were completed for all main breeding subpopulations.

- Information on population trends indicate that actions taken by Laboratory appear to be having positive effects on the recovery of Hawaiian monk seal subpopulations at Kure and Laysan Islands.

- Pups born at French Frigate Shoals suffered unusually high mortality from predation by tiger sharks and mobbing by males; population trends at FFS continue to show downward spiral. Recovery analysis and actions are used to seek an understanding of these problems.

- Mortality of pups and juvenile seals caused by marine debris appears to be increasing.

- Efforts to remove marine debris, including submerged debris, are increasing. New understanding of Hawaiian monk seal pelagic ecology, which will assist in mitigating these problems, is emerging.

- A panel of wildlife and veterinarian experts was assembled and recommendations were received regarding captive female juvenile seals that have been afflicted by an unknown eye ailment, investigations for assessing the health status of captive and wild seals, and possible rehabilitation actions.

Recovery of Pacific Sea Turtles

- The nesting index for the Hawaiian green sea turtle population continues to show increase; the 1997 nesting season at East Island in French Frigate Shoals showed largest number of turtles censused, over 500, in 25 years that systematic surveillance has been conducted.

- Research and monitoring studies are yielding considerable new biological and ecological understanding of the Hawaiian green sea turtle.

- Progress made in determining the etiological agent responsible for fibropapilloma disease, which is a serious potential threat to the continued recovery of Hawaiian green sea turtle.

- Very successful program initiated at the Honolulu Laboratory for training Pacific island technicians in methods and techniques for monitoring and assessing sea turtle populations.

Interactions of Hawaii Longline Fishery With Sea Turtles and Seabirds

- Methods were refined and estimates were made of the fleet-wide sea turtle takes and mortalities resulting from longline fishery interactions during 1992-96.

    - Estimates of takes of loggerhead turtles by the total fleet in 1995 and 1996 exceeded the level allowed by the NMFS Biological Opinion which triggered a Section 7 consultation. Laboratory scientists provided extensive scientific support during the consultation, and research on factors associated with takes is proceeding.

- Investigation of observer logbook records from 1992 to 1996 suggest that loggerhead sea turtle takes are associated with latitude (most takes north of 30°N), catch of swordfish, and size of vessel (most takes by vessels larger than 70 feet); olive ridley sea turtle takes were found to be weakly associated with yellowfin tuna catch; no relationships were found for takes of leatherback and green sea turtles and factors related to fishing. Analysis of these factors may assist in investigation efforts.

- The increased number of longline fishery interactions with sea turtles during 1997 may be related to variations in oceanographic conditions. The southward shift and intensification of the ocean frontal structure associated with the Subtropical Front near 30°N appears to have set up conditions that resulted in concentrations of loggerhead sea turtles that overlapped with swordfish habitat and longline fishing operations. Likewise, oceanographic features appear to have played a role in the increased interactions of the longline fishing with olive ridley sea turtles. In this case both olive ridley sea turtles and longline fishing for yellowfin tuna were concentrated in relatively well-developed oceanographic eddy structures off the west side of the Island of Hawaii, which most likely originated from meander patterns for the North Equatorial Current.

- Post-hooking survival of sea turtles is being successfully investigated using ARGOS satellite transponders that provide information on turtle movement and activity. Through September 1997 satellite tags were attached to 11 loggerhead sea turtles by SWR observers on board commercial longline fishing vessels.

- Stock identity of sea turtles taken incidently by the Hawaii-based longline fishing is being investigated using mtDNA techniques in a study exemplifying cooperative efforts within the NMFS. Tissue collection kits and training are provided by scientists at the Honolulu Laboratory, samples are collected by SWR observers from turtles taken during commercial fishing operations, samples are analyzed at the SWFSC genetics laboratory in La Jolla, and the study is being funded by the NMFS Office of Protected Species. Progress is being made.

- Fleet-wide albatross seabird mortalities are being estimated using data collected by SWR observers on commercial longliners and methods developed by Laboratory scientists for estimating takes of sea turtles. The seabird mortality information is provided to the WPRFMC and the USF&WS. The Laboratory is also cooperating with these organizations in studies to evaluate actions that may reduce seabird mortality caused by longline fishing.

Oracle Conversion and Fisheries Data Management

- Refinements made to data base model for converting fisheries data to Oracle system.

- Key pelagic fishery data sets and sea turtle data have been entered into the Oracle database and tested. Additional pelagic data sets are being entered; e.g., fish auction and market sampling data.

- NWHI lobster data entered and tested in prototype Oracle database model; data from observers carried by lobster fishing vessels during 1997 successfully entered directly into Oracle.

- Hawaiian monk seal data are entered and analyzed in an Oracle functional database; conversion to fixed enterprise model underway as time permits.

- User access now available on test basis to fixed and customizable reports, data browsers, and detailed data.

- Efforts underway for user access to Oracle data products via a web site.

- GIS integration with Oracle database being investigated.

Director's Office, Administration, and Information Technology Support

- Progress on schedule for actions related to the laboratory new building construction.

- Major facility improvements were made at the Kewalo Research Facility to support captive care and rehabilitation of monk seals and to support biological and fibropapilloma research on sea turtles.

- All major and most other environmental compliance issues were successfully resolved at the main Laboratory and at the Kewalo Research Facility; guidelines and protocols were put in place; and training was provided to key staff.

- Several security measures were installed at the main Laboratory and the Kewalo Research Facility.

- A new and expanded accounting system is being put into effect for fiscal monitoring of individual projects funded by Laboratory grants awarded to UH/JIMAR.

- A firewall was installed and other computer security measures were adopted for the Laboratory computer systems.

- Several improvements were made to the Laboratory computer and communications systems, including installation of new servers, upgrades to major software packages, and installation of a T1-communications line between the main Laboratory on the UH campus and the Kewalo Research Facility.

- The capabilities for scientific illustration support were significantly upgraded and expanded.

- Laboratory participation in community outreach activities to promote public awareness of NMFS research activities in of support fisheries management and recovery of the Hawaiian monk seal and Pacific sea turtles was increased. Laboratory scientists took part in 18 public events including career days at schools, open houses, Hawaii Fishermen's Festival, fishing tournaments, Earth Day celebration, and related activities.

NOAA CoastWatch

- New and expanded computer and communications systems were installed for automatic receiving, processing, distributing, and archiving of HPRT/AVHRR infra-red sea surface temperature data products.

- The NOAA/CoastWatch Site and the Honolulu Laboratory received high profile exposure when specialized satellite-derived sea surface temperature products and narrative interpretations that were provided to the 1997 Hawaii Invitational Billfish Tournament held in Kailua-Kona on the Island of Hawaii.

- The Hawaii CoastWatch site was named by NASA to collect and process SeaWiFS satellite ocean color station in the central Pacific; preparations made to receive and process ocean color data with funding provided by NOAA/NESDIS.

Publications and Scientific Meeting Presentations

- Forty-one manuscripts were approved, submitted for publication, in press, or published by Laboratory scientists during FY 1997. The number of publications by category are:

  Fishery biology/ecology - 5
  Fisheries and fishery interactions - 6
  Physical and biological oceanography - 5
  Hawaiian monk seals - 5
  Sea turtles - 14
  Fisheries economics and social science - 6

- The Laboratory staff also prepared 34 administrative reports, abstracts, and workshop proceedings (see Appendix M for listing of all manuscripts).

- Laboratory scientists gave 30 presentations at 25 scientific meetings and gave numerous presentations at WPRFMC Plan Team, Science and Technical Committees, and full council meeting.

FY 1998 PROGRAM EMPHASIS

Scientific Support for Building Sustainable Fisheries

Research Related to Pelagic Fisheries FMP

Expand swordfish research according to the Laboratory' s Swordfish Research Plan

- Estimate life history parameters for input into stock assessment models.
- Collaborate with scientists internationally to obtain catch and effort statistics for swordfish and other longline pelagics.
- Develop basin-wide models of resource habitat and dynamics.
- Develop cooperative conventional tagging project with industry.
- Conduct sonic tracking.
- Field test "pop-up" satellite transmitting archival tag.

Enlarge shark bycatch research

- Lead JIMAR/PFRP shark bycatch project.
- Monitor bycatch and "finning."
- Initiate research related to blue shark population assessment and impacts on North Pacific fishery stocks.

Conduct research on bigeye tuna biology, ecology, and stock assessment in conjunction with swordfish research.

Research Related to NWHI Lobster FMP

Prepare harvest guideline for 1998 fishing season.

Conduct research cruise for population assessment and recruitment research.

Increase industry involvement and cooperation in research.

Conduct tagging studies to estimate population dynamics parameters.

Research Related to Bottomfish FMP

Conduct biological analysis regarding management of MHI bottomfish.

Undertake economic policy analysis regarding management strategies for limited access in NWHI.

Conduct stock identification and population dynamics research on selected bottomfish species.

Provide scientific advice as needed to NMFS/SWR and WPRFMC on Hancock Seamount fishing moratorium.

Fishery Monitoring

Complete WPacFIN upgrades to State of Hawaii fishery systems.

Initiate fisheries summary statistics access system via website.

Provide online fishery data management catalog and documentation.

Complete WPacFIN island fishery agency upgrades to Windows.

Regularize WPacFIN PPA funding for central WPacFIN staffing.

Evaluate shoreside monitoring programs.

- Review statistical design for sampling programs.
- Establish reliable data set linkages.
- Review and document data processing procedures.

Investigate research access to VMS (vessel monitoring system) satellite transponder vessel tracking data.

Fishery Economics Research

Complete JIMAR economics projects.

Participate in NMFS economics steering committee.

Scientific Support for International Management of Pacific Highly Migratory Species

Host 1998 Interim Scientific Committee meeting.

Conduct research in support of ISC.

- Lead ISC swordfish working group.
- Participate in ISC efforts regarding data needs.
- Initiate internal planning to develop a research program on marlins to present to ISC at next meeting in 1998.
- Host ICS meeting.

Participate as appropriate in newly developing organization for management of western Pacific highly migratory species.

Fisheries Research in Marine Ecosystems

Continue applications of research cruise, satellite, and ocean model data to fisheries oceanographic studies on swordfish and other pelagics.

Update NWHI ecosystem time series and links to oceanographic indices.

Use most recent basin-scale physical data including TOPEX altimetry data to evaluate whether a regime shift began in 1996.

Continue forage studies for swordfish and monk seals.

Initiate work under the NMFS strategic initiative: Essential Fish Habitat.

Research In Support of Recovering Protected Species

Hawaiian Monk Seal

Assess population status and collect biological data at main breeding sites.

Provide husbandry, investigate eye ailment, and assess diagnostic results for captive juveniles with eye ailment.

Conduct epidemiological studies on seals.

- Develop improved medical screening protocol for pups in rehabilitation program
- Evaluate role of disease in wild populations

Mitigate decline of population at French Frigate Shoals as funding allows.

- Salvage reproductive potential of immature females.
- Implement translocation programs contingent on health evaluations of donor and recipient populations.

Seek funding for habitat restoration to remove marine debris from beaches and submerged reefs, and disentangle seals.

Conduct research and recovery operations at Midway Island as funding allows.

Continue pelagic ecology studies as funding allows.

Pacific Sea Turtles

Conduct research in support of NMFS Biological Opinion on longline interaction.

- Prepare analyses and participate in Section 7 actions as requested by SWR
- Estimate turtle take and mortality from longline fishery
- Expand investigation of post-release survival of hooked turtles
- Enlarge sampling for genetic study of turtle stocks involved in longline fishery interactions

Continue monitoring and assessment of green turtle nesting at East Island, French Frigate Shoals.

Estimate green turtle population model parameters from tag-resight and survey data.

Develop quantitative methods for assessment of green turtle fibropapilloma disease and population recovery monitoring.

Refine prototype sea turtle population assessment model (TURTSIM) to support longline fishery impact assessments, analysis of Hawaiian green turtle population dynamics, and fibropapilloma epidemiology.

Provide leadership in the implementation of the U.S. Pacific Sea Turtle Recovery Plans working in collaboration with the SW Region, the U.S. Pacific territories, and the Regional Marine Turtle Conservation Program of SPREP.

Conduct research on population status, distribution, and biology of Pacific sea turtles in cooperation with Pacific Rim and Island Nations.

Provide training opportunities in turtle research techniques to foster data exchange and analysis with Pacific Rim and Island Nations.

Continue leadership and coordination in research on fibropapilloma.

- Investigate pathology, epidemiology, and etiology
- Monitor infection rate at key locations in Hawaii
- Host workshop to update strategic plan on research

Infrastructure and Support of Laboratory Operations

Director's Office and Administration

Complete actions for new building design decision.

Promote/develop cooperative research with industry.

Continue expansion of community outreach.

Expand team-building training and coaching to Swordfish Research Team and Hawaiian monk seal research and recovery group.

Continue remedial actions for environmental compliance.

Encourage staff cross-training.

Continue automation of administrative functions.

Scientific and Technical Support Services

Computer systems, communications, and networks.

- Upgrade Laboratory scientific support services, PCs, and scientific UNIX workstations for pelagic fisheries and stock assessment research.
- Upgrade IT-95 computer system according to funds received from NMFS Headquarters.
- Continue upgrade of LAN with twisted pair and fiber optics.
- Provide computer and communication support to new SWR/PAO offices, as needed.
- Continue improvements to Laboratory website.

Oracle System Conversion

Continue conversion of fisheries and protected species databases to Oracle.

Continue development of applications software.

Integrate Oracle with GIS .

Distribute Oracle products to users via website.

APPENDIXES

APPENDIX A: MAJOR PROGRAM ELEMENTS AND MILESTONES, FY 1998

Fisheries Management Science

Problem Statement

Management of central and western Pacific marine fisheries and recovery of protected species by NMFS, the WPRFMC, and multinational bodies requires reliable and timely scientific advice based on comprehensive fishery monitoring, stock assessment, and biological and oceanographic research.

Objectives

(1) To provide timely and accurate assessments of the status of important fish stocks in the western and central Pacific.

(2) To develop understanding of relationships and linkages between physical ocean processes (circulation, frontal structure, etc.) and biological and ecological processes (resource distribution and availability, population dynamics, productivity, predation, etc.) and the relationships of both to fisheries.

(3) To provide fundamental biological and ecological research on Federally managed species for improved understanding of the mechanisms that control resource distribution and abundance.

Methodology/Approach

(1) Stock assessment and management analyses are conducted with mathematical and statistical models and computer simulations, using data from field surveys and laboratory studies;

(2) A variety of statistical and modeling techniques are used in studies of ocean processes and ecosystem dynamics to analyze and integrate in situ data from oceanographic and biological surveys, fisheries data, output from numerical ocean circulation models, and data on sea surface temperature, wave height, and other variables from satellite-borne remote sensors;

(3) Fish biology and ecology studies are based on biological observations collected in field surveys with a variety of sampling gears, laboratory studies of biological specimens, and data from tag and recapture experiments (standard tags, with pop-up archival tags soon to be deployed). Several statistical and analytical methods are applied.

Fishery Monitoring and Economics

Problem Statement

Data collection and reporting for Federally managed domestic fisheries in Hawaii, as well as economic and operational analysis directed towards fisheries management, is a central element of the Honolulu Laboratory mission. The information compiled and analyses prepared by Honolulu Laboratory staff are used for domestic fisheries management in Hawaii, as well as for basic biological research, and fisheries management assistance to American Samoa, Guam, Hawaii, and the Northern Marianas.

Objectives

(1) To provide fisheries-dependent data for biological and economic research.

(2) To provide reports on the status of landings and fishing activities.

(3) To conduct economic and operational research.

Methodology/Approach

(1) Fisheries data are collected through Federal logbook programs, shoreside monitoring of landings, market sampling, and special surveys of fishery participants. Data are compiled in integrated data bases and made available to other users through the Laboratory's data manager. Data are also acquired by research programs at the Honolulu Laboratory and through data share agreements with other agencies.

(2) Status reports are prepared by FMPI staff on each monitored fishery

(3) Economic research includes cost-earnings analysis of the major commercial fleets, as well as studies on operational dynamics and seafood markets. The FMPI economist also serves as principal investigator for contract socioeconomic research.

(4) FMPI staff serve on plan monitoring teams of the Western Pacific Regional Fishery Management Council, as well as other scientific and advisory committees, including the WPacFIN Fishery Data Coordinating Committee.

Protected Species – Monk Seals

Problem Statement

The Hawaiian monk seal is the only endangered pinniped found entirely in U.S. waters. Its population is currently estimated at 1,300 to 1,400 individuals and has declined at a rate of approximately 5% per year during the last decade.

Objectives

(1) To mitigate the decline at French Frigate Shoals through assessment of health and disease, causes of mortality, foraging patterns, and reef fish productivity.

(2) To translocate and rehabilitate (if necessary) seals from French Frigate Shoals to other sites for bolstering population growth as indicated and possible.

(3) To investigate the etiology of the eye ailment currently affecting captive juveniles at the Kewalo facility.

(4) To enhance population recovery at Midway Atoll by mitigating factors inhibiting population growth and introducing rehabilitated seals from other subpopulations.

(5) To characterize and protect foraging habitat and prey resources through investigations of monk seal pelagic ecology.

(6) To facilitate translocation efforts and understand the role of health and disease in captive and wild seals through epidemiological investigations.

(7) To minimize injury and mortality caused by marine debris.

Methodology/Approach

(1) A field camp will be established at French frigate Shoals to study, among other things, survival rates and sources of mortality; feeding habits; animal condition; growth; and behavior. Investigations will determine if the decline at French Frigate Shoals continues or has begun to abate.

(2) Investigate risk factors associated with previous rehabilitation/release efforts to bolster population growth and design new protocols to maximize the probability of success.

(3) Continue diagnostic evaluation of the eye ailment to evaluate the origin of the disease (captive or wild).

(4) Complete the Midway Recovery Plan to guide recovery actions at that site.

(5) Investigate the pelagic ecology of monk seals to identify critical foraging habitat, evaluate the relative importance of various prey species, and assess factors influencing prey abundance and availability. A detailed foraging plan will be used to systematically address specific topics of this investigation.

(6) Complete a comprehensive epidemiological plan of investigations to guide and prioritize these recovery actions and begin evaluating potential donor and recipient populations.

(7) Continue efforts to remove and destroy marine debris found on seals and on land during all field camps. Additional work will involve preliminary efforts to assess and remove marine debris found on coral reefs surrounding monk seal reproductive sites.

Protected Species – Marine Turtles

Problem Statement

This program supports the NMFS mission and responsibility to monitor, achieve increased understanding of basic biology, and ultimately to recover marine turtles in the Pacific that are listed under the U.S. Endangered Species Act. The program also assists in reducing interactions with marine turtle species that may impede the development of sustainable commercial fisheries. The overall problem is being addressed under the framework of an Interim Hawaiian Sea Turtle Recovery Plan, by a draft U.S. Pacific Sea Turtle Recovery Plan, by formalized research plans prepared by experts to address the fibropapilloma disease problem in sea turtles, and by research plans to reduce sea turtle hooking interactions by the North Pacific pelagic longline fishery.

Objectives

(1) To obtain reliable scientific information on the biology, ecology, and life history of Hawaiian and other Pacific marine turtles;

(2) To monitor and determine the population status of Hawaiian and certain other Pacific marine turtles, and to refine and improve the assessment techniques being employed;

(3) To investigate the scope, magnitude, and cause of the fibropapilloma disease problem affecting marine turtle populations in Hawaii, Florida, and certain sites elsewhere worldwide, and to devise solutions or containment measures for this disease;

(4) To investigate, delineate, mitigate and/or prevent interactions of longline fisheries with pelagic marine turtles in the North Pacific involving species mainly of non-Hawaiian origin.

Methodology/Approach

(1) Research techniques involve the mark and recapture of turtles both in the sea and on nesting beaches in order to obtain essential data on population size, health status, essential habitats utilized, growth rates, migrations, natural predation, human-related mortality, productivity, and survivorship.

(2) Basic research tools employed include netting, skin and scuba diving, satellite telemetry, cooperative assistance of commercial and recreational fishermen, shipboard fishery observers, computerized data processing, developing and refining simulation models, and cooperative and contracted fibropapilloma disease researchers specializing in sea turtle pathology (including parasitology and immunology).

Administration & Research Support

Problem Statement

The Director's office, Administration, and Scientific Support Services provide overall management guidance/leadership and all administrative support for the Honolulu Laboratory scientific and technical support programs. Ensure efficient and effective use of human, facility, computer resources, and fiscal resources. Serve as focus for communication of scientific programs with outside agencies and public. Interact with WPRFMC to provide scientific advice for fishery management.

This group supports all the scientific programs underway at the Honolulu Laboratory.

Objectives

(1) To provide scientific guidance and overall management and Administration of both human and fiscal resources for the Honolulu Laboratory;

(2) To improve accountability of human and fiscal resources for all laboratory functions;

(3) To improve productivity and efficiency for scientific programs, technical support programs, and Administration.

(4) To ensure that all published materials are in compliance with established formats (both internally and externally) and that they are written clearly and of high quality.

(5) To provide computer and library resources to the scientific, technical, and management staff of the Honolulu Laboratory, Regional Office, and JIMAR.

(6) To provide electronic communication services to permit sharing of information locally, nationally, and internationally.

(7) To provide consultation and assistance on computer-, library-, and editorial-related questions.

Methodology/Approach

(1) Provide scientific leadership to staff on research directions and seek adequate funding for research;

(2) Improve facilities provide conducive environment for work and to provide state-of-the art equipment and support to staff to increase efficiency;

(3) Seek training opportunities in all areas to improve staff skills and to develop teamwork among all disciplines of research to maximize sharing of resources and to provide cooperation.

(4) Provide editing, typing, filing, proofreading, and development of graphics for scientific publications.

(5) Provide community outreach to constituent and general public.

HONOLULU LABORATORY MILESTONES FOR FISCAL YEAR 1998

CYOP	Milestone description	Completion date	Person responsible
Fishery Stock Assessment milestones			
702	Issue annual NWHI lobster *status of stocks* report	Apr 98	Gerard DiNardo
702	Prepare annual Hawaii bottomfish *status of stocks* report	Jul 98	Don Kobayashi
Fishery Evaluation milestones			
701	Prepare annual reports on Federally-monitored fisheries (Hawaii bottomfish, lobster, longline fisheries, and American Samoa longline fishery)	Jul 98	Sam Pooley
701	Produce current year volume of *Fishery Statistics of the Western Pacific* from WPacFIN data.	Jun 98	David Hamm
Marine Mammal & Sea Turtle Assessment milestones			
703	Complete annual Technical Memorandum on Hawaiian monk seal *status of stocks* and field studies	Sep 98	Tim Ragen
171	Issue status report on collaborative modeling of Mexican leatherback population dynamics for MEXUS-Pacifico meeting	Sep 98	Jerry Wetherall
Additional milestones			
703	Complete manuscript on 1997 NWHI reef surveys	Jun 98	Ed DeMartini
702	Complete manuscript on size-at-maturity for slipper lobster	Mar 98	Ed DeMartini

702	Complete manuscript on study of lobster larval transport dynamics in the NWHI based on satellite altimetry	Mar 98	Jeff Polovina
702	Organize and issue report for 1998 tuna conference	Jun 98	Chris Boggs
703	Complete revised report on the use of video technology ("crittercam") for identification and assessment of Hawaiian monk seal habitat	Dec 97	Frank Parrish
702	Host 2nd meeting of Interim Scientific Committee on Tuna and Tuna-like Species, including Swordfish working group	Sep 98	Michael Laurs
702	Publish proceedings of Second International Swordfish Symposium	Jun 98	Gerard DiNardo
703	Complete revised recovery plan for Midway Atoll monk seal population	Apr 98	Bud Antonelis
703	Complete review and publish manuscript on monk seal rehabilitation	Apr 98	Tim Ragen
171	Issue report on Workshop on Statistical methods for estimating incidental takes of sea turtles and seabirds in longline fisheries	Sep 98	Jerry Wetherall
704	Host and issue report for 2nd international turtle fibropapilloma disease workshop	Apr 98	George Balazs

APPENDIX B: HAWAII AND AMERICAN SAMOA DOMESTIC LONGLINE EFFORT, LANDINGS, AND CATCH RATES

Hawaii-Based Longline Fishery, 1987-96

The Hawaii-based domestic longline fishery is the largest commercial fishery in Hawaii and the largest domestic fishery based in the central and western Pacific. Broadbill (swordfish), tunas, and sharks dominate the catch. Landings in 1996 were 21.5 million pounds with an ex-vessel value of $24.8 million, which was essentially the same as 1995. Two recent developments include the continued resurgence of swordfish catch rates (but with a continued decline in effort through 1996), following a significant decline in catch rates in 1994, and the growth of albacore landings. Albacore is also the focus of the American Samoa domestic longline fishery. Most information in this report is from Ito and Machado (1997).[1]

Data are compiled from Federal logbooks and market monitoring information by NMFS Honolulu Laboratory staff. Catch is determined from longline logbook records noting the number kept[2] of each species, plus the number released. Species identification of some marlins may be in question. Landings are estimated by multiplying longline logbook number kept by market monitoring estimates of average round weight per fish for each species.

The NMFS longline logbook program began late in 1990; complete figures exist only for the period 1991-96. The NMFS market monitoring program began in 1984 through the Western Pacific Fishery Management Council, with NMFS staffing from 1987. The extent of the market sample varies annually, but since the inception of the swordfish fishery the sample includes both the Honolulu auction and the major swordfish brokers in Honolulu. Market samples are also available from the Big Island.

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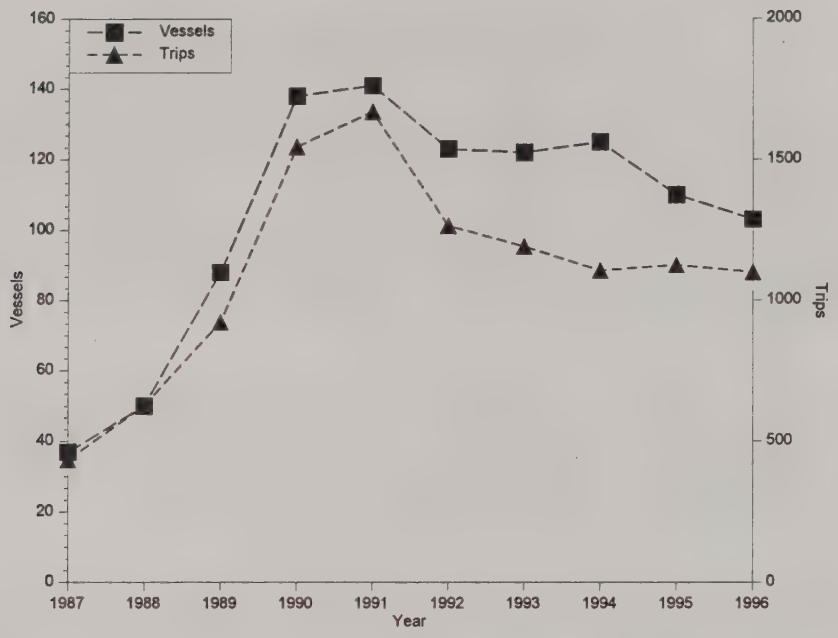
[1]Ito, R. Y, and W. A. Machado. In press. Annual report of the 1996 Hawaii-based longline fishery. SWFSC Administrative Report.

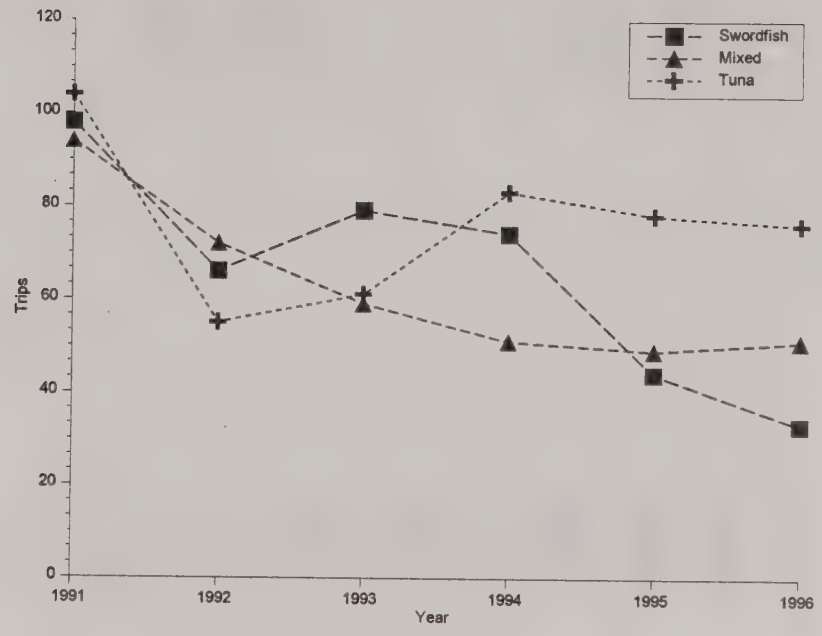
[2]Including number finned for 1996 shark catch.

Hawaii-based domestic longline fishing effort, 1987-96.



	Vessels, Trips, Hooks (1,000)		
Year	Vessels	Trips	Hooks (1,000s)
1987	37	435	
1988	50	627	
1989	88	923	
1990	138	1,546	
1991	141	1,670	11,914
1992	123	1,265	10,946
1993	122	1,192	12,137
1994	125	1,106	11,319
1995	110	1,125	14,155
1996	**103**	**1,100**	**14,141**
Average	104	1,099	12,435
Standard Deviation	36	374	1,392

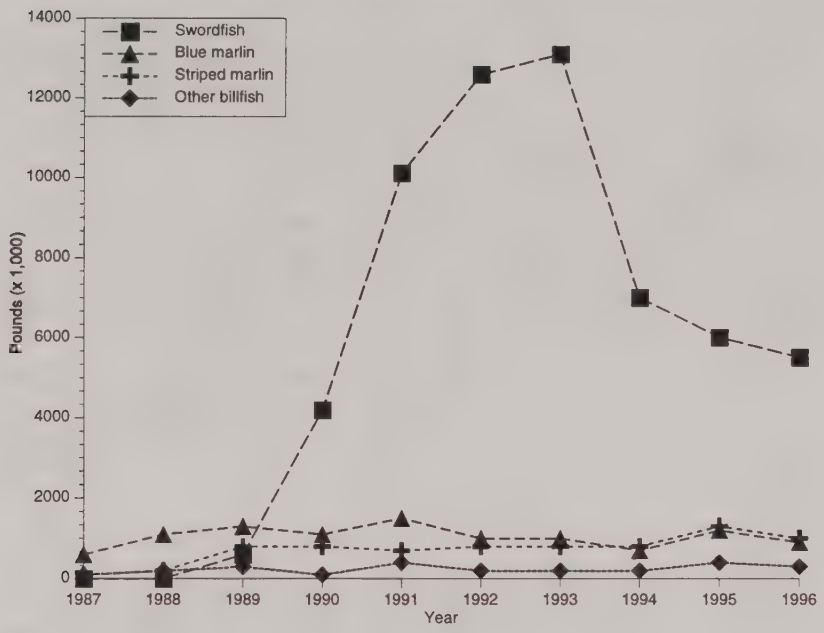
Hawaii longline trips by trip-types, 1987-96.



Year	Longline Trips by Trip Types			
	Total	Swordfish	Mixed	Tuna
1987	435			
1988	627			
1989	923			
1990	1,546			
1991	1,670	291	823	556
1992	1,265	277	530	458
1993	1,192	319	331	542
1994	1,106	310	228	568
1995	1,125	136	307	682
1996	**1,100**	**92**	**351**	**657**
Average	1,099	238	428	577
Standard Deviation	374	98	217	82

Data: Trip types are determined by NMFS staff following each trip from longline vessel captains or by knowledge of a particular fishing vessels operating patterns and the location and catch from a particular trip. Trip types were not available until the longline logbook program beginning in 1991.

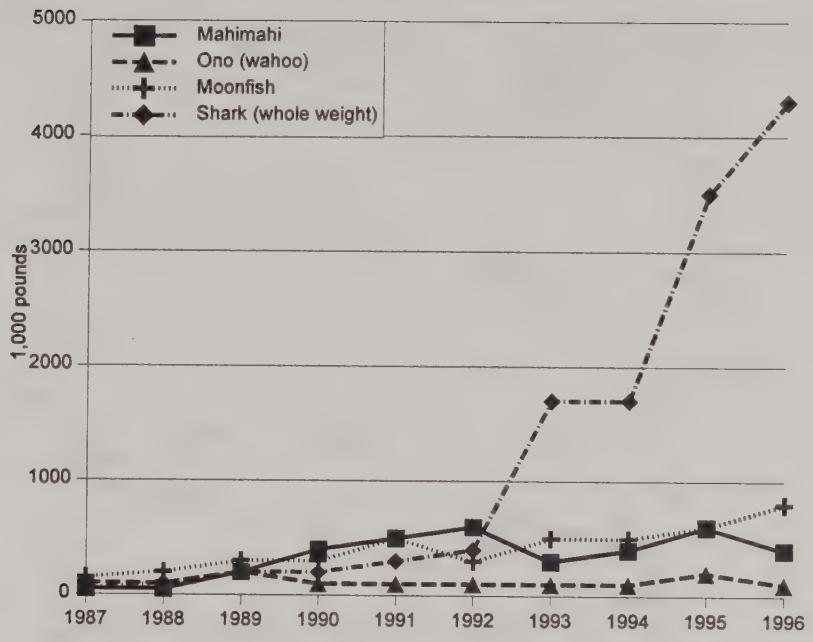
Hawaii domestic longline landings -- all billfish, 1987-96.



Year	Pounds Landed (1,000s)			
	Swordfish	Striped marlin	Blue marlin	Other billfish
1987	0	600	100	100
1988	0	1,100	200	200
1989	600	1,300	800	300
1990	4,200	1,100	800	100
1991	10,120	1,500	700	400
1992	12,600	1,000	800	200
1993	13,100	1,000	800	200
1994	7,000	700	800	200
1995	6,000	1,200	1,300	400
1996	**5,500**	**900**	**1,000**	**300**
Average	5,912	1,040	730	240
Standard Deviation	4,905	267	350	107

Comment: The dramatic decline in swordfish landings since 1993 represents the change in targeting practices. Other billfish species are within their recent ranges, except for blue marlin, which has increased during the past 2 years.

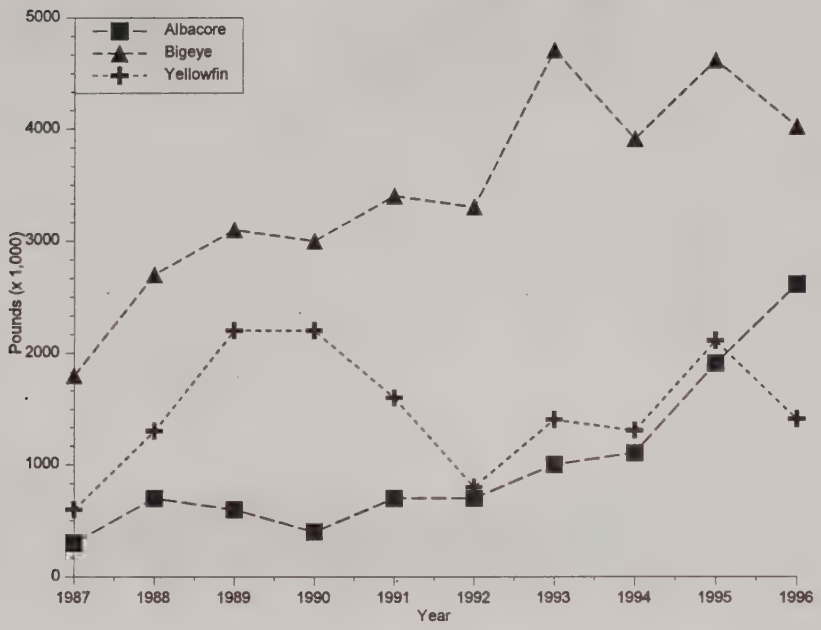
Hawaii longline landings – other pelagics, 1987-96,



Year	Mahimahi	Ono (wahoo)	Moonfish	Shark (estimated round weight)
1987	50	100	150	50
1988	50	100	200	100
1989	200	200	300	200
1990	400	100	300	200
1991	500	100	500	300
1992	600	100	300	400
1993	300	100	500	1,700
1994	400	100	500	1,700
1995	600	200	600	3,500
1996	400	100	800	4,300
Average	467	117	533	1,983
Standard Deviation	121	41	163	1,623

Comment: Mahimahi availability is highly variable year to year, while ono and moonfish have been relatively steady. Shark is primarily taken as a finned product. These landings figures are estimated whole weight of the entire shark.

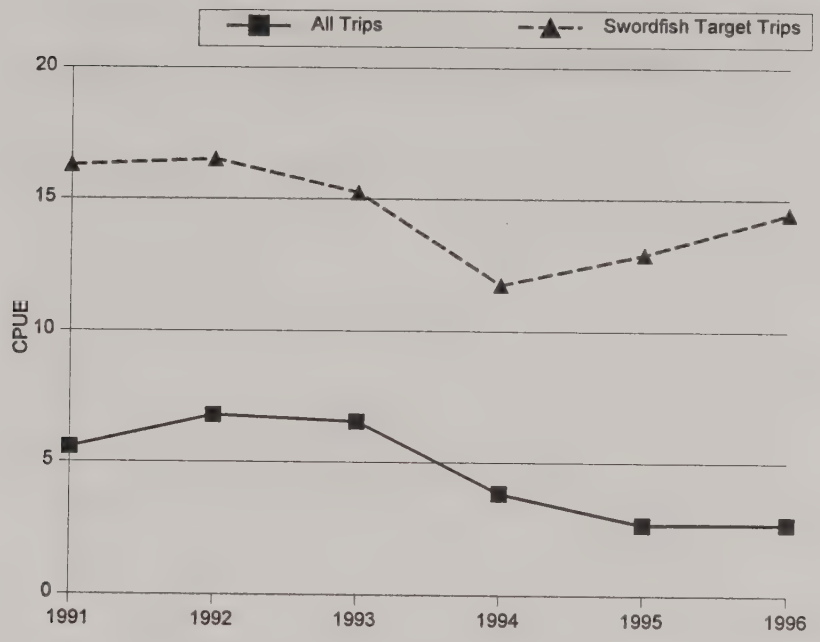
Hawaii longline landings -- tunas, 1987-96.



	Pounds Landed (1,000s)		
Year	Albacore	Bigeye	Yellowfin
1987	300	1,800	600
1988	700	2,700	1,300
1989	600	3,100	2,200
1990	400	3,000	2,200
1991	700	3,400	1,600
1992	700	3,300	800
1993	1,000	4,700	1,400
1994	1,100	3,900	1,300
1995	1,900	4,600	2,100
1996	**2,600**	**4,000**	**1,400**
Average	1,000	3,450	1,490
Standard Deviation	720	883	553

Comment: All tuna species show increasing landings over the past four years as targeting towards tunas has returned. Albacore landings have shown the greatest increase.

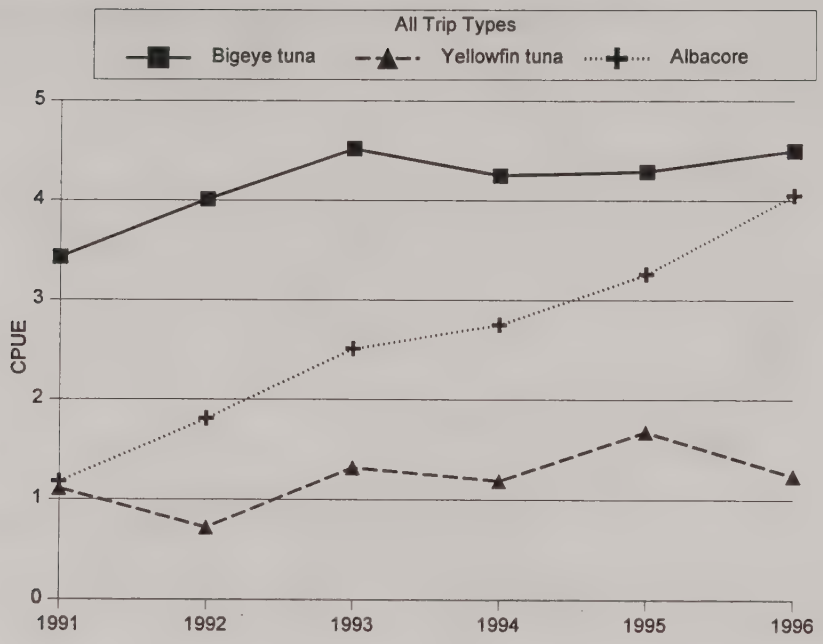
Hawaii longline swordfish catch rates, 1991 - 96.
(Number caught per 1,000 hooks)



Type of Trip	**All Trips**	**Swordfish Trips**
1991	5.56	16.28
1992	6.79	16.50
1993	6.55	15.25
1994	3.83	11.77
1995	2.66	12.92
1996	**2.70**	**14.47**
Average	4.68	14.53
Standard Deviation	1.87	1.88

Comment: Although catch rates of swordfish for all longline trips has continued to decline since 1993, this is primarily due to changes in targeting toward tuna. Swordfish-directed trips have seen their catch rates return to the 1993 levels, after a sharp decline in 1994 catch rates. This one-year drop in swordfish CPUE was discussed in last year's program review.

Hawaii longline tuna catch rates, 1991 - 96.
(Number caught per 1,000 hooks)

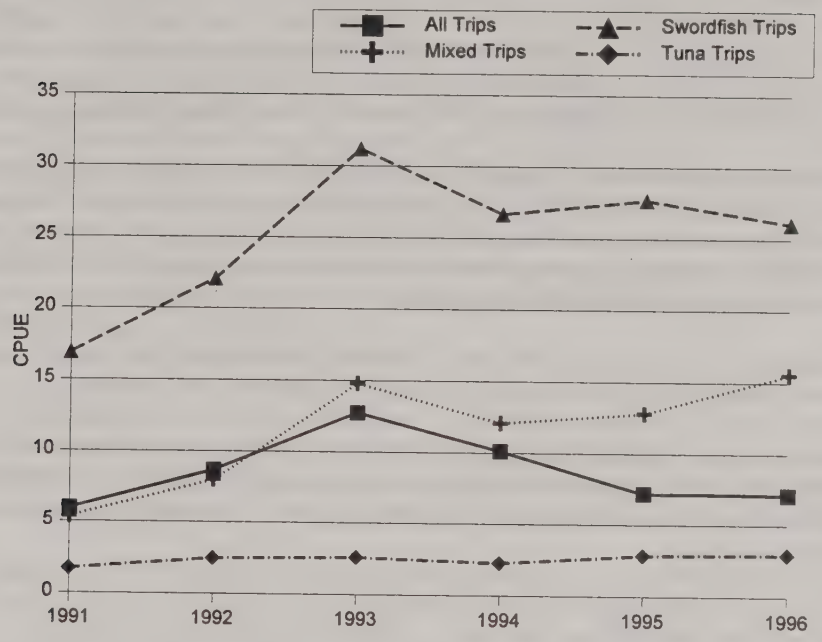


All Trips

Species	Bigeye tuna	Yellowfin tuna	Albacore
1991	3.43	1.11	1.18
1992	4.01	0.72	1.81
1993	4.52	1.32	2.51
1994	4.25	1.19	2.75
1995	4.29	1.68	3.26
1996	**4.50**	**1.24**	**4.05**
Average	4.17	1.21	2.59
Standard Deviation	0.41	0.31	1.02

Comment: Tuna are caught ubiquitously across trip-types, although catch rates vary. Bigeye tuna is caught primarily on tuna-targeted and mixed-target trips, while albacore is caught on swordfish and mixed trip types.

Hawaii longline shark catch rates, 1991-96.
(Number caught per 1,000 hooks)



Sharks

Trip Type	All Trips	Swordfish Target	Mixed Target	Tuna Target
1991	5.97	16.89	5.37	1.74
1992	8.67	22.06	7.98	2.48
1993	12.74	31.20	14.78	2.60
1994	10.13	26.68	12.08	2.28
1995	7.19	27.69	12.80	2.86
1996	**7.14**	**26.07**	**15.54**	**2.95**
Average	8.64	25.10	11.43	2.49
Standard Deviation	2.47	4.98	3.98	0.44

Comment: Approximately 95% of all shark caught are blue sharks. In 1996, 56% of blue sharks were released. Almost all of those kept were kept as a finned product.

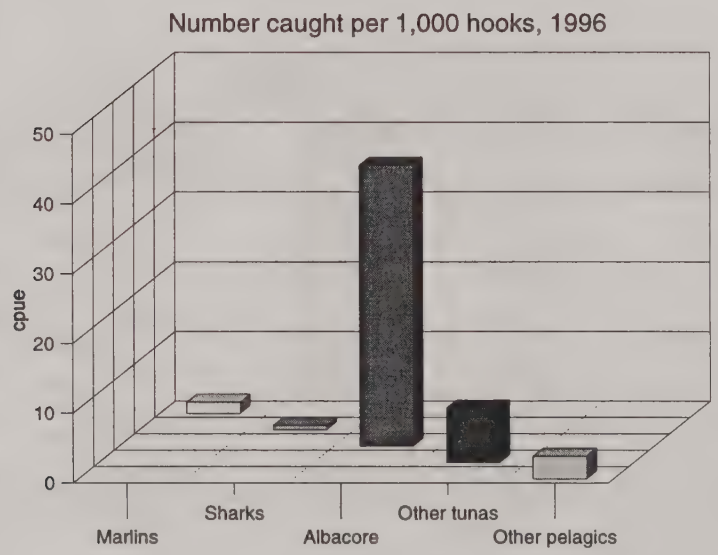
American Samoa Domestic Longline Fishery

An emerging domestic longline fishery in American Samoa is now 3 years old. This domestic fleet is composed of small aluminum or wood and fiberglass boats called *alia*. Most of these boats are approximately 30 feet long and are powered by gas outboard engines. They have neither electrical nor hydraulic equipment on board. Navigation is visually by landmarks. Longline gear is stored on hand-cranked reels and can consist of more than 10 miles of monofilament.

The fishery is monitored under Federal regulations for the central and western Pacific proposed by the Western Pacific Regional Fishery Management Council. This requires both permits and logbooks for the American Samoa vessels but does not require observers. Logbooks are monitored through collaboration between the American Samoa fisheries office and the NMFS SWR staff in Pago Pago. The data are compiled by the Honolulu Laboratory.

There were four boats operating late in 1995 and nine reporting in 1996. Most trips last one day, with the average vessel reporting 59 sets per year (188 hooks per set).

Albacore is the predominant species in the fishery. Approximately 50,000 pounds were caught in 1995 and 233,000 pounds in 1996. Catch per 1,000 hooks dramatically exceeds the Hawaii longline fishery's performance: 40.28 albacore per 1,000 hooks in American Samoa and 4.05 albacore in Hawaii.



APPENDIX C: STATUS OF THE HAWAII-BASED LONGLINE FISHERY FOR SWORDFISH AND HONOLULU LABORATORY RESEARCH ON SWORDFISH

Background Information

Swordfish are widely distributed in the tropical, subtropical, and temperate waters of the world's oceans. They have been harvested for centuries and continue to be the subject of important fisheries worldwide. In the North and South Atlantic Ocean, overfishing has depleted swordfish stocks. There is no indication that swordfish are being overfished in the Pacific Ocean. However rapid growth in longline fisheries for Pacific swordfish has raised concerns about potential overharvesting and need for appropriate management safeguards to assure the health of swordfish stocks. Improved understanding of the status of Pacific swordfish stock(s) is vital to ensure the viability of the Hawaii-based swordfish industry.

The Hawaii-based domestic longline fishery increased its landings of swordfish from 100,000 pounds (round weight) in the late 1980s to 13.1 million pounds in 1993, when it accounted for about 40% of eastern central Pacific swordfish landings (approximately 40%). Hawaii landings have since declined to 5.5 million pounds (see Appendix B), but interest remains strong in this economically important fishery ($13.3 million), particularly given the condition of the Atlantic fishery.

Management of the Hawaii domestic longline fishery is included in the WPRFMC Pelagics Fisheries of the Western Pacific Fishery Management Plan (FMP). Management actions include limited entry to avoid overcapitalization of the fleet, mandatory logbooks to record information on catch and effort, closed areas to avert contact with Hawaiian monk seals and to avoid fishery interactions with Hawaiian small-boat fisheries, and a mandatory observer program to obtain information on fishery interactions with sea turtles. The number of longline vessel permits is capped at 167, with about 110-120 vessels active in the fishery.

In addition to the Hawaii longline fishery, the North Pacific swordfish resource is also harvested by Mexico, Japan, and other Asian countries, as well as U.S. vessels operating out of mainland ports. Most of these catches are taken in international waters, and most of the Asian fisheries swordfish catches are taken in fishing operations targeting tunas. The status of the swordfish stock in the North Pacific and the maximum sustainable yield are unknown. Comprehensive data to assess stock status and fishery impacts are unavailable.

The U.S. and Japan signed an agreement in late 1995 concerning international scientific studies required for the eventual international management of highly migratory fishes in the North Pacific Ocean and formed the Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC). The membership of the ISC has been expanded to include other countries harvesting highly migratory species in the North Pacific Ocean, including Mexico, Canada, South Korea, Peoples Republic of China, and Taiwan (latter with observer status). In addition, observer status has been granted to some international organizations with fisheries interests, including the Inter-American Tropical Tuna Commission, South Pacific Commission, and PICES. Swordfish has been selected as one of the primary species for international study under ISC. The U.S. was selected to be the lead country of an ISC committee for organizing and coordinating international swordfish research, and the NMFS Honolulu Laboratory has been designated as the primary federal research laboratory for swordfish in the U.S.

Goals and Objectives of NMFS Honolulu Laboratory Swordfish Program

The goals of the NMFS Honolulu Laboratory swordfish research are to provide scientific information and advice 1) for support of the WPRFMC Pelagic Fisheries FMP, which includes swordfish, and 2) for support of U.S. interests in the eventual international management of swordfish in the Pacific Ocean. The objectives of the Honolulu Laboratory research program research include:

(1) Developing knowledge of swordfish stock dynamics and structure.

(2) Attaining comprehension of swordfish distribution, migration, habitat, and physical processes that determine variability in the swordfish ecosystem.

(3) Acquiring understanding of fleet economics and industry dynamics.

(4) Leading international cooperative swordfish research conducted under the auspices of the *ISC.*

Major Research Activities

Development of Swordfish Research Plan

A comprehensive, multidisciplinary research program has been developed where swordfish research is addressed as a system that includes the swordfish resource, the environment within which it lives, the fisheries that operate on it, and the interactions and relationships among these components.

Stock Assessment

In accordance with recommendations of the ISC Swordfish Working Group, NMFS scientists at the Honolulu Laboratory will undertake a collaborative stock assessment of Pacific swordfish resources and evaluate the impact of the Hawaii longline fishery, and other fisheries harvesting swordfish, on North Pacific swordfish stocks. The assessment will help identify any needs for management action and additional research required to improve the reliability of stock assessments.

Biological Knowledge Required for Stock Assessment

Biological information is required in order to assess the status of a fish stock, principally information on size and age distributions, size at age, size at sexual maturity, sex composition, and growth rates. Information on many of these basic biological parameters for Pacific swordfish is missing or incomplete, and research is underway to acquire it. Various methodologies are being used to evaluate the most appropriate way for ageing (and validating the ages of) swordfish. These include analyses of various hardparts (otoliths or ear bones, vertebrae, and fin rays)

employing special preparations and examination by light and scanning electron microscopy, as well as high technology microconstituent analyses. See Appendix C1 regarding biological information and research for swordfish stock assessment.

Swordfish are landed by fishermen almost always as a "dressed" product, meaning that the entrails (including reproductive organs) have been removed, as have the fins and much of the skull. This poses a major challenge for determining the sex composition of the fish landed and length-weight interrelationships. To overcome these obstacles, research is underway to convert measurements taken on dressed swordfish to measurements for whole fish and to determine the sex of dressed carcasses using biochemical analyses. Most of these studies rely on research operations conducted at sea on the NOAA ship *Townsend* Cromwell or on tissue specimens collected aboard commercial longline vessels by Southwest Region observers (see Appendix C1). Whole small swordfish are also returned to the Honolulu Laboratory by cooperating fishermen.

Distribution and Migration Patterns

A swordfish tagging program conducted in cooperation with the Hawaii swordfish industry industry has been initiated. This study will yield missing information on swordfish distribution and migration, as well as data for population assessment and direct measurement of interactions among the fleets fishing for swordfish. So far, five recovered tags show movements from the western central North Pacific to the eastern North Pacific. On another project that will involve high technology, development is underway on an electronic tag to be used on swordfish to store information on a fish's location, its swimming depth, and water temperature. The device will be attached to swordfish and programmed to separate from the fish after a prescribed period of time (up to about one year), float to the sea surface, and transmit the stored information on movement patterns and habitat to satellite sensors, which will relay the information to readout stations on Earth. This project is being led by Honolulu Laboratory scientists in collaboration with the University of Hawaii's Pelagic Fisheries Research Program, fisheries scientists in Australia, and hydrodynamic and design engineers in Israel.

Swordfish Oceanography, Habitat, and Ecosystem

A series of oceanographic research cruises on the *Towsend Cromwell* has been conducted, and more are planned to identify physical and biological factors which are the basis for the Hawaii swordfish fishery fishing grounds. In addition, high technology satellite remote sensing data are being applied to describe the spatial and temporal dynamics of mesoscale ocean features in the swordfish fishing grounds and their links with fishery catch-per-unit-effort (CPUE). Links between Hawaii longline CPUE and large scale features such as the Kuroshio Extension Current dynamics are also being addressed. The research is being continued with satellite data, research grounds and their impact on the fishery. Output from a wind-driven circulation model is also being used to identify features in Hawaii's swordfish fishing ground. A study of swordfish diet is ongoing. See Appendix C2 for research habitat and Appendix C3 for research on environmental and operational factors affecting longline fishing.

Fishery Monitoring

The Honolulu Laboratory is responsible for the collection, compilation, and summary of Federal logbooks for the Hawaii domestic longline fishery. This monitoring process, which includes swordfish, also involves working with fishermen on species identification as well as on accurate logging of the number of fish caught and the number released. All longline logbook data have recently been converted to the Oracle database system to improve management and access to the data. Laboratory staff, with assistance from La Jolla staff, recently completed a comprehensive data dictionary for the U.S. swordfish fisheries in the North Pacific. Plans are to work through the ISC to expand this dictionary to include foreign swordfish fisheries data.

Fishery Economics and Fleet Dynamics

The Hawaii Fleet, Industry, and Vessel Economics project is designed to provide information on economic and industry dynamics of the Hawaii pelagic fishing industry, including the swordfish industry. This project is directed by a Honolulu Laboratory industry economist and is conducted cooperatively with the University of Hawaii's Pelagic Fisheries Research Program that provides most of the funding. The objective of this research is to provide fishery management information based on economic characteristics and dynamics of the Hawaii pelagic fisheries. Progress on the project includes the completion of both a comprehensive cost-earning analysis of the Hawaii-based longline fleet and an initial economic analysis of longline fishing dynamics. Plans are to extend the longline cost-earnings analysis into a spatial model and to complete a comparison of longline set, trip, and vessel economic analysis of the longline fleet, including the swordfish component.

Scientific Leadership for ISC International Swordfish Research

The Honolulu Laboratory planned, organized, convened, and hosted an International Pacific Swordfish Symposium at Kahuku, Hawaii during early March 1996. The symposium was held under the auspices of the ISC. The purpose of the symposium was to provide a forum for review and synthesis of recent developments in biological, fisheries oceanography, and resource assessment research on swordfish in the Pacific Ocean and relevant research in other oceans, and to promote international scientific collaboration in assessments of Pacific Ocean swordfish. Approximately 200 scientists and technicians, representing seven countries, participated in the symposium. The conclusions and recommendations resulting from the symposium will be of significant benefit to research conducted on Pacific swordfish.

The first meeting of the ISC Swordfish subcommittee was held following the symposium. Representatives from the U.S., Mexico, Japan, Inter-American Tuna Commission, and South Pacific Commission participated in the meeting that was hosted by the Honolulu Laboratory. An approach was agreed upon for initiating international cooperative research on Pacific swordfish, as well as exchange of data.

Appendix C1: Biological Information for Swordfish Stock Assessment

The basic biological data required for stock assessment include size-age relationship and growth rate, size and age at sexual maturity, size and sex composition of catch, and stock structure. For swordfish, which are landed "dressed" (all entrails including reproductive organs removed) in the Hawaii-based longline fishery, data on the sex of landed fish are also needed. Research in 1997 emphasized age-growth and stock structure.

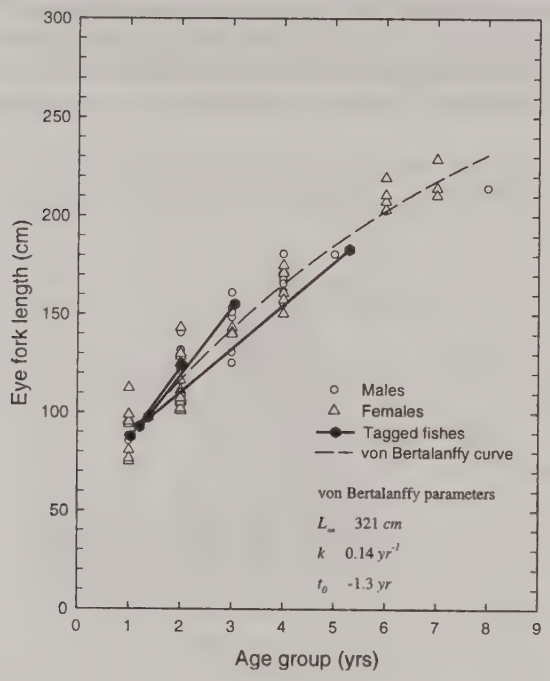


Figure 1.

Research on swordfish growth and size-age relations has keyed on three elements: identifying and using a hardpart suitable for large-scale processing; evaluating another hardpart that might be used to corroborate size-age relationships; and validating age estimates. The second ray of the first anal fin has been identified as suitable, and a total of >800 cross-sections prepared to date. More than 600 cross-sections have been analyzed for proportionality between fin ray radius and fish length. Proportionality is present and precise. These and additional fin ray specimens are now being further evaluated for such things as differential resorption of early annuli in older fish of various ages. Otoliths (Sagittae) are being examined as the complementary hardpart. The Sagittae of 15 age 0+ to I+ fish have been examined thus far using scanning electron microscopy. Counts of presumed "daily" micro increments and data on length frequency progressions are being used to verify the ages of fish aged as one-year-olds using fin ray annuli. Sagittae are also now being examined for internal annular features using transverse sections; presumed annular features ("ridges") on the external surface of Sagittae have not proved useable. For validation, several approaches are being taken. Three of the five tagged swordfish recaptured to date provide growth increment data that can be reasonably related to a preliminary length-at-age curve (Fig. 1). Marginal increment analysis--to test whether a recognizable feature is formed once at the same time each year--is also being conducted using fin rays.

Estimates of body size at sexual maturity for swordfish were largely completed in FY 1997. Female swordfish caught by the Hawaiian longline fishery mature at about 143 cm eye-to-fork length (EFL) and 60 kg dressed weight; males mature at about 102 cm EFL and < 20 kg (Fig. 2). A manuscript on size at maturity has been drafted for publication in *Fishery Bulletin.*

The sex-specific size composition of swordfish in the Hawaii-based longline catch has now been described using a total of 6,639 fish caught through June 1997 (Fig. 3). Fish were sexed aboard ship by SW Region observers and sex was later verified by microscopic examination of gonads (0.5% error rate). Patterns of sex-specific size composition are included in the ms on size at maturity. A separate technical report describing body length-weight relationships and length conversions is being drafted.

Potential stock structuring of swordfish within the Pacific has been evaluated, using mitochondrial and nuclear DNAs, at several laboratories. Present data and analyses indicate a possibly distinct swordfish stock in the Chilean fishery and likely large-scale mixing of swordfish in western, central, and eastern North Pacific fisheries. Recent development of an effective method

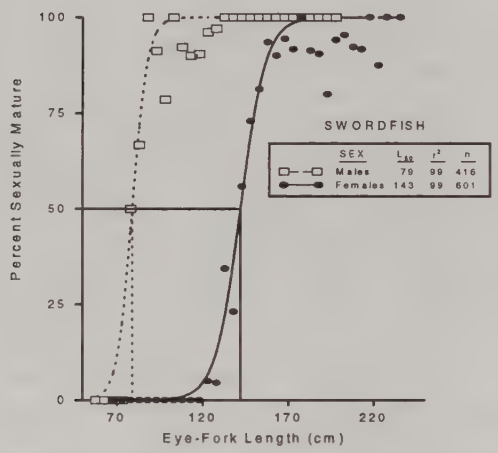


Figure 2.

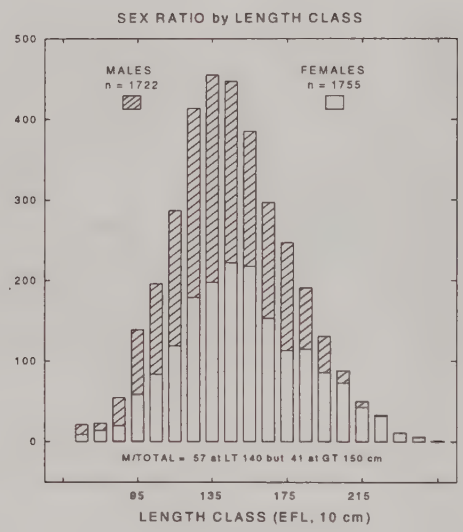


Figure 3.

of collecting pelagic larvae will enable future reexamination of the genetic similarity among year-classes of swordfish collected near Hawaii and elsewhere.

A preliminary chemical assay for identifying the sex of landed swordfish was completed in 1997, using polyclonal antibodies (pAB) to the vitellogenin (VTG, a chemical precursor to oocyte yolk) of another fish species. Because swordfish are landed dressed, large-scale sexing of landed fish requires such an unconventional chemical assay. The results using pABs were only partly successful because VTGs differ among teleost species and the pABs strongly cross-reacted with other proteins. A follow-up study, using monoclonal antibodies (mAB), made directly against swordfish VTG, was initiated using swordfish collected on a spring 1997 research cruise. The mAB research is being conducted by the University of Florida, Gainesville.

Appendix C2: Fishery Oceanography

Pelagic Ecosystem: Subtropical Front Index for the Swordfish Fishery

Swordfish CPUE from the Hawaii-based longline fishery is monitored by the Western Pacific Regional Fishery Management Council. Interannual changes in CPUE may indicate a change in the population of swordfish or may reflect a change in the oceanography of the fishing ground which alters the availability and catchability of swordfish. Interpreting whether a change in CPUE is the result primarily of a population change or largely an environmental change is often a difficult problem. However, we have developed an index of the oceanography of the swordfish fishing grounds which appears to address this problem.

Figure 1 shows the monthly swordfish CPUE and the mean monthly sea surface height over the fishing ground measured from TOPEX/POSEIDON altimetry. Notice that there is a sharp drop in sea surface height at the end of each year which coincides with the increase in CPUE. This sharp drop in sea surface height indicates a drop in water column temperature caused by a shallowing of the thermocline and transport of colder water from the north both driven by an intensification of the winter atmospheric circulation. The cold dense water produces the Subtropical Front temperature fronts important to swordfish forage and the fishery. Our oceanographic index is computed as the magnitude of this sharp drop in mean sea surface height at the end of each year. Figure 2 shows that this index,

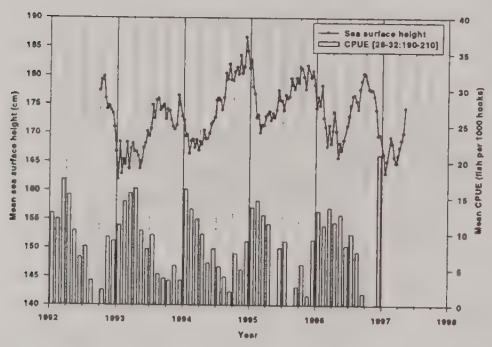


Figure 1.

which we also call the Subtropical Front Index, is strongly correlated with swordfish CPUE in recent years. This index was low in 1994 when the CPUE was also low, and hence we conclude that low 1994 CPUE was the result of weak frontal conditions and not a change in swordfish population size. The index which is computed at the beginning of the fishing season indicates that 1997 environment conditions in the fishing ground are excellent and should lead to high 1997 CPUE.

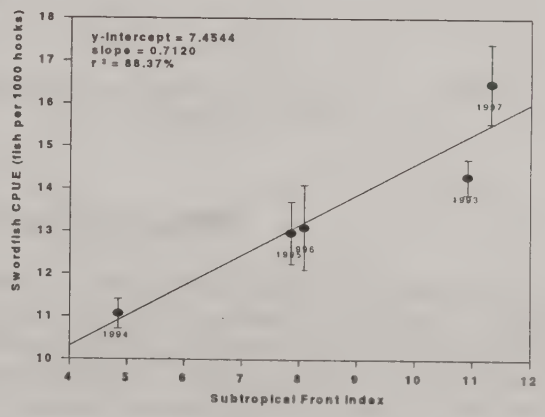


Figure 2.

NWHI Ecosystem

Productivity of key NWHI species has remained low since the regime shift of the mid-1980s (Fig.3).

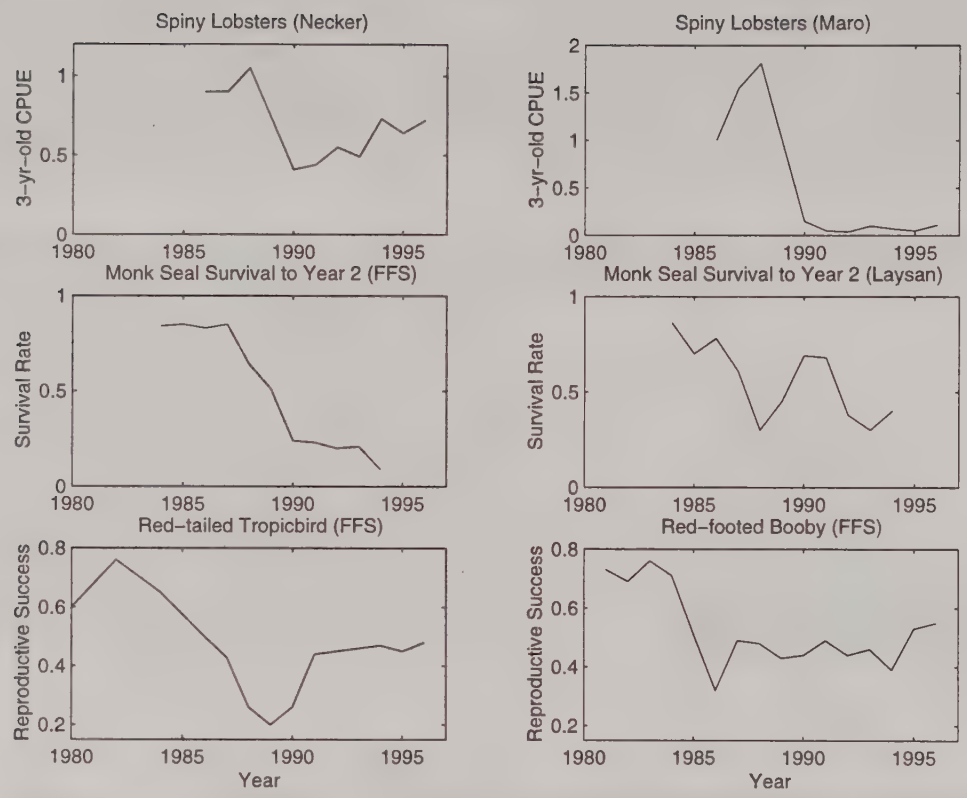


Figure 3. Information on population abundance indices for several species in the NWHI Ecosystem.

Monk Seal Forage Ecology

Studies of the forage ecology of the monk seal continued, including work at French Frigate Shoals (FFS) with video cameras. The picture emerging is that for adult seals at FFS forage habitat is very specific. They forage on the bottom in depth range of 50-80 m, along the interface between sand and rubble substrata, often traveling to banks 60-100 km from FFS. The seals feed on new recruits which settle into the rubble habitat as well as larger fishes which reside in the adjacent sand habitat.

Lobster Dynamics

Satellite altimetry has been applied to investigate the spatial dynamics of the NWHI spiny lobster fishery. Specifically, fisheries landings and research trapping show recruitment to the fishery

collapsed in 1990 in the northern portion of the fishing ground and has shown no recovery through the present, while 670 km to the southeast, recruitment has remained relatively strong. An advection-diffusion model is used to investigate larval transport dynamics between these two regions. The movement model is driven by geostrophic currents computed every 10 days from sea surface height obtained from the TOPEX/POSEIDON satellite. The larval transport simulations indicate that even though the larvae have a pelagic period of 12 months, banks differ substantially in the proportion of larvae they retain from residence spawners as well as the proportion of larvae they receive from the other banks. Specifically, Necker has a high larval retention rate and receives larvae from both Maro and Oahu. However, Maro has a lower larval retention rate and is up current from Necker so doesn't receive larvae from Necker.

Appendix C3: Research Important to the Hawaii-Based Longline Fishery

Hawaii Pelagic Fishery Time Series

A research project involving long-term Hawaii pelagic fisheries time series data has been completed. The goals of this research were to establish meaningful time series of pelagic fish availability and fishing pressure in Hawaii, and to develop analytical models for variation in pelagic fish availability (CPUE) in relation to potential influences including local fishing intensity. All available data on catch and effort for Hawaii pelagic fisheries were assembled, with emphasis on yellowfin and bigeye tuna, blue marlin, and mahimahi. Errors and other problems with the fishery statistics were addressed including catch underreporting, species misidentification, lumping of catches, inadequate classification of fishing effort, and exclusion of zero-catch trips. In most cases, practical solutions to these data problems were found and meaningful time series of CPUE were estimated. Time series analysis of HDAR data did not show any consistent pattern of negative effects on tuna CPUE resulting from increases in fishing. Results for blue marlin and mahimahi were less clear and require further evaluation.

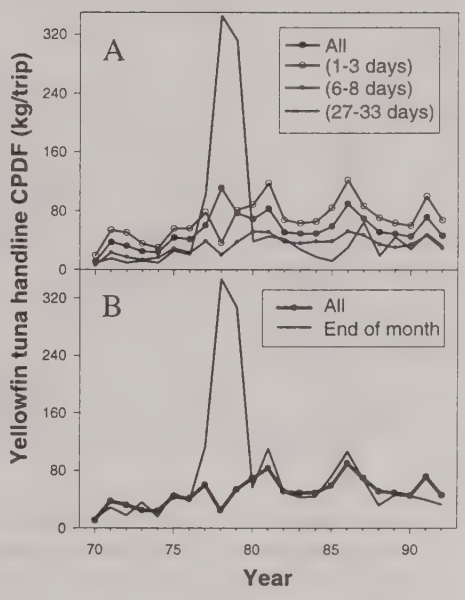


Figure 1. Time series of yellowfin tuna handline 1970-1992. (A) Shows all trips and trips stratified by reporting interval. (B) Shows all trips with monthly summary trips for 1978-79.

Information from independent fish dealers, wholesale market monitoring projects, and previous studies were used to gauge the amount of fish not reported to HDAR by different fishery sectors. Previous studies also found substantial underreporting problems by Hawaii longline vessels from 1979 to 1989 A set of raising factors were estimated to correct the HDAR longline data. Derived independently, these raising factors are similar to those used in the Pelagics Annual Reports, and confirm that approach. Comprehensive information on handline and troll catch was available for 1980, 1981, and 1988 and indicated that underreporting by commercial handline and troll fishermen was not too severe with reported catches to HDAR representing about 80% of actual total catch. Troll and handline catches are not raised in this study or in the Pelagics Annual Reports.

Commercial catches reported to HDAR are the only continuous long-term time series of data on Hawaii's handline and troll fisheries. The validity of HDAR data has often been called into question, specifically for its lack of a specific measure of effort, and until 1989 for its lack of information on unsuccessful fishing trips (zero catch trips). To address these problems, dates of catch from 1970-92 were used as a measure of effort (fishing days) and intervals between dates fished were examined as a second variable. In 1978-79, catch per days fished (CPDF) was anomalous for catches reported one month apart, strongly suggesting that catches for many days fished were summed in monthly reports. The time series of CPUE were improved by elimination

of the monthly reports in those years. For other years, CPDF data stratified by intervals between reports, showed similar trends for different intervals. Thus, corrected CPDF data appear to provide a useful index of fluctuations in troll and handline fishery performance. Other analyses showed that mean CPDF, excluding days which caught no species at all, was highly predictive of mean CPDF including zero catch days). Thus, lack of data on fishing days with no catch throughout much of the time series does not invalidate the use of CPDF as an index of fishery performance. These and other problems with the Hawaii pelagic fishery statistics are described in a manuscript that will be submitted for publication in *Fishery Bulletin*.

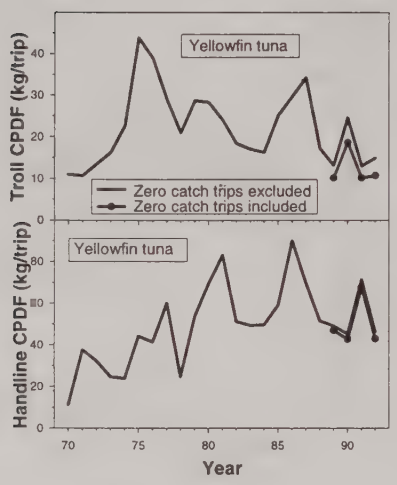


Figure 2. Time series of yellowfin tuna CPDF by Hawaii handline and troll fisheries from 1970-92 with and without zero catch.

Simulations models of relationships between total catch and CPUE were created under different scenarios of certain key parameters: migrations rates, fishing mortality, and catchability. Time series of total catch and CPUE produced by these models was analyzed using time series transfer function models, and these models were also applied to real commercial fisheries data from Hawaii's yellowfin tuna fisheries. Results from the simulation models and the real data were used to estimate the power of the transfer function models to detect local fishery impacts. The simulation models included stochastic processes in migration rates, fishing mortality, and catchability. Total catches of yellowfin tuna from 1962 to 1994 were estimated for three fishing gear types: longline, troll, and handline. Results indicated that total catches by Hawaii's fishery sectors have low probabilities of affecting local CPUE for yellowfin tuna. A previous analysis also found no impact of local harvest on bigeye tuna CPUE. These results have been presented to the WPRFMC and published. Further analysis is focusing on additional species especially blue marlin and mahimahi.

Research on Environmental and Operational Factors Affecting Longline Fishing

In the Hawaii-based longline fishery, changes in fishing operations to target different species produce changes in the effectiveness of fishing effort units. CPUE indices used in resource monitoring were improved by segregating dissimilar types of fishing effort. Cluster analysis was used to classify longline sets in relation to species composition of the catches in 1991-1994 (Fig. 3) and these results were published. Tests of this technique to show that the same sets tended to cluster together even when major changes in the CPUE of target species were simulated. Three clusters contained most of the sets, and the catch compositions suggested targeting for either broadbill swordfish (two clusters) or bigeye tuna. The other two clusters indicated a mixed-species fishing strategy. Fishing operations were most different between sets in the tuna and swordfish clusters.

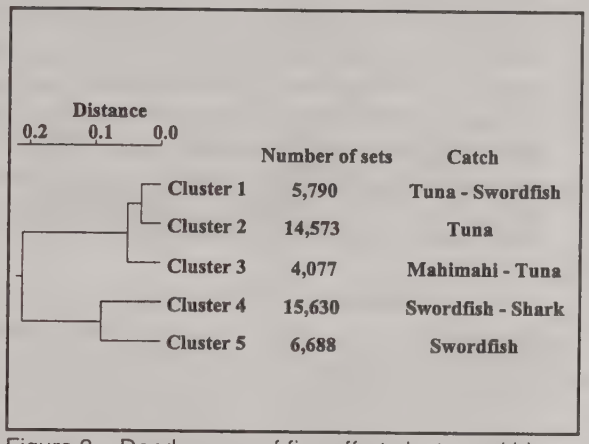


Figure 3. Dendrogram of five effort clusters within the Hawaii-based longline fishery (1991-1994).

Catch, effort, and CPUE data on longline sets in the swordfish and swordfish-shark clusters were analyzed in relation to environmental data on three spatiotemporal scales (Fig. 4). Integrating data at various time and space scales may prove crucial in developing fishery oceanographic relationships because biological and environmental processes exhibit variability on distinctly different scales. A multi-channel sea surface temperature (MCSST) data product was derived from Advanced Very High Resolution Radiometer (AVHRR) measurements to provide weekly composites at ~18-km resolution. Two other SST products were based on an optimal interpolation (OI) analysis of blended in situ (ship and buoy) SST data, and AVHRR satellite retrievals computed on a 1° grid at weekly and monthly time scales.

Distribution of effort in relation to SST was bimodal, with modes occurring at 18 and 24°C. The bimodal SST preference was related to seasonal isotherm movements through the fishery. The 18°C mode was largely composed of effort concentrated at the subtropical front (27-32°N) during winter and spring. The 24°C mode was composed of effort scattered north of the Hawaiian Archipelago in summer and early fall. Swordfish longline effort was significantly autocorrelated on lunar and seasonal scales. Corresponding CPUE estimates were also autocorrelated on a lunar scale for swordfish and other pelagic species. Cross-correlation analyses between CPUE and moon phase time series identified that CPUE was coherent with the moon phase at short time lags (<3 days) for most species; thus, higher CPUE was associated with full moon events.

The relationship between fishing performance and environmental variables are very unlikely to be linear. This study used general additive models (GAMs) as a means of identifying factors influencing swordfish catch rates and for determining the nature of the relationships. GAMs do not

assume any restricted relationship between the response and predictor variables. The analysis described the relationship between fishing performance and various sea surface temperature (SST) features and other factors on CPUE of swordfish and blue shark. Relationships were analyzed for seven physical factors (latitude, longitude, SST, SST frontal energy, temporal changes in SST, temporal changes in SST frontal energy, and bathymetry) all of which may affect fish availability or catchability. Three factors (number of light sticks per hook, lunar index, and wind velocity) which primarily affect catchability were also analyzed. Frontal energy was calculated as an average of the temperature differences between each pixel and the surrounding nine pixels (called a 3x3 sobel operator, Fig. 4).

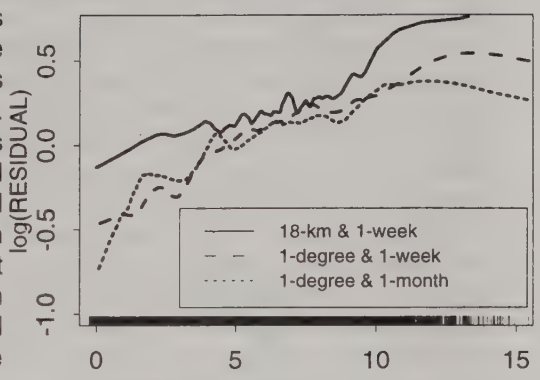


Figure 4

Depending on the scale of SST data (18-km weekly, 1°-weekly, or 1°-monthly), GAM analysis of the 10 factors accounted for 39-42% and 44-45% of the variance in CPUE for swordfish and blue shark, respectively. Swordfish CPUE increased with latitude to peak at 35-40°N and increased in the vicinity of temperature fronts and during the full moon. The frontal preferences of swordfish are hypothesized to be linked to habitat or food availability, which are related to the dynamics of the subtropical and subarctic fronts. Shark CPUE also increased with latitude up to 40° N, and increased westward, but declined abruptly at SSTs colder than 16°C.

A generalized linear model (GLM) analysis of the longline CPUE data by season (month 1-12) and area (5° square) accounted for nearly as much variation as the GAM analysis, suggesting that the variation accounted for by the GAM was mostly spatial and seasonal. The results of this work were submitted for publication in *Fishery Oceanography.*

To explore further the effects of habitat on longline CPUE, time-depth-recorders are being given to NMFS longline fishery observers in order to describe the depth strata and thermal structure typically exploited by commercial longline gear (Fig. 5). Data have been received from >400 longline sets and characterize the variability in depth targeting between tuna and swordfish fishermen. The objective is to categorize longline fishing effort based

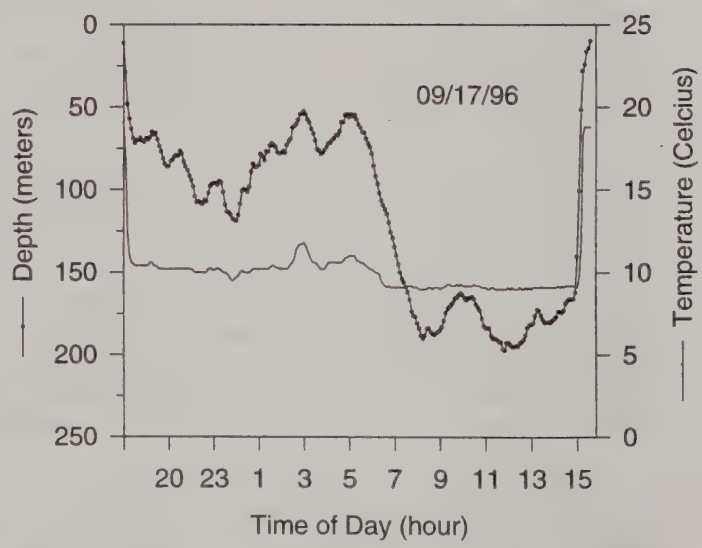


Figure 5. An example of a time-depth temperature (TDR) record from the deepest hook position on one commercial longline set showing that as the fishing depth increased by about 100 m at 0600-0800, the temperature of the surrounding water dropped by about 2.5°C.

on operational characteristics that affect the depth and time of fishing as an alternative to the clustering method based on catch composition. Fishing depth affects catch rates dramatically (Figs. 6 and 7).

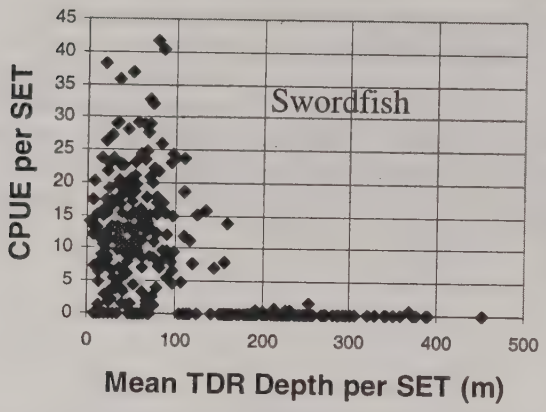


Figure 6. Swordfish CPUE (number of fish/set) on 402 commercial longline sets in relation to the average depth recorded at deep hook positions.

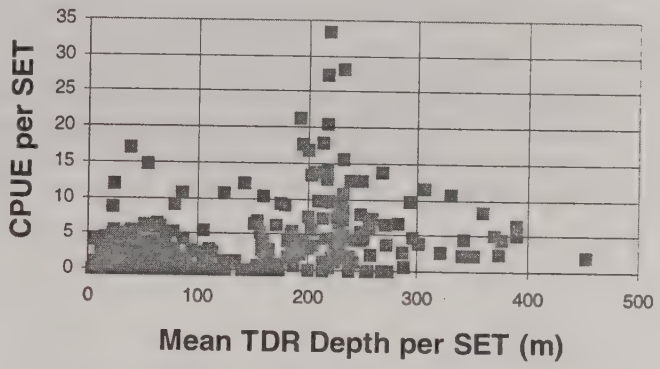


Figure 7. Bigeye tuna CPUE on the same 402 commercial longline sets as shown in the previous figure, in relation to average gear depth at the deep hook positions

Archival Tagging Project

To understand harvest impacts and interactions among fisheries across the Pacific, information is needed on swordfish migration patterns and on how environmental factors influence distribution and catchability. The recent development of archival tags and their use on tuna by CSIRO provides a new tool for studying movement and habitat over long periods. Decades of conventional tagging and ultrasonic tracking research have not been able to provide the important insights into long term cyclical movement patterns produced by archival tags. For species such as the swordfish, marlins, and perhaps sharks, in which recapture rates are likely to be very low, the high cost of archival tags is a major deterrent to their use. Recognizing this, a new pop-up, satellite-transmitting archival tag (PSTAT) is under development. These tags will be released from fish at predetermined times, pop up to the surface of the ocean, and transmit a record of movements and habitat use back to researchers via satellite. Rapid external attachment of PSTATs will be achieved by harpooning an intra-muscular tag anchor into the fish which then trails the tag on a tether (Fig. 8).

During 1996-97 the project developed and tested a number of essential elements of the PSTAT that were not being adequately covered by commercial electronics companies.

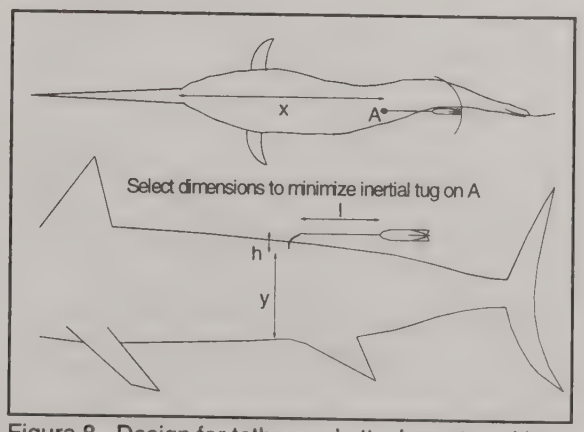


Figure 8. Design for tether and attachment position

Anchors were designed and tested successfully on tuna. A hydrodynamic pop-up tag container, incorporating a micro-controller-operated release mechanism was designed and wind-tunnel tested. The new PSTAT body has a round nose ogival design with ducted tailfins and trailing antenna. A pyrotechnic detachment mechanism forces the nose cone, to which the tether is attached, forward out of the tag body, leaving the PSTAT positively buoyant. Geolocation software for use on archival tag and PSTAT light/depth/time data has been developed by CSIRO.

Deployment of tags planned for this year was delayed because PSTATs are not yet available from manufacturers. However, the last 18 months have allowed significant progress to be made which will make the application of the technology more likely to succeed. Meanwhile, regular archival were purchased tags for investigations involving bigeye tuna, a species with much higher recapture rates. Approximately 80 tuna will be tagged with archival tags during 1997-98.

APPENDIX D: NORTHWESTERN HAWAIIAN ISLANDS LOBSTER

Background and Status

Crustacean fisheries within the U.S. Exclusive Economic Zone in the Western Pacific are managed by the Western Pacific Regional Fishery Management Council (WPRFMC) under the Fishery Management Plan for the Crustaceans of the Western Pacific Region (Crustaceans FMP). Most crustacean landings come from the Northwestern Hawaiian Islands (NWHI) lobster trap fishery which targets the Hawaiian spiny lobster (*Panulirus marginatus*) and slipper lobster (*Scyllarides squammosus*) (Fig. 1). Information on the CPUE for the fishery is found in Figure 2.

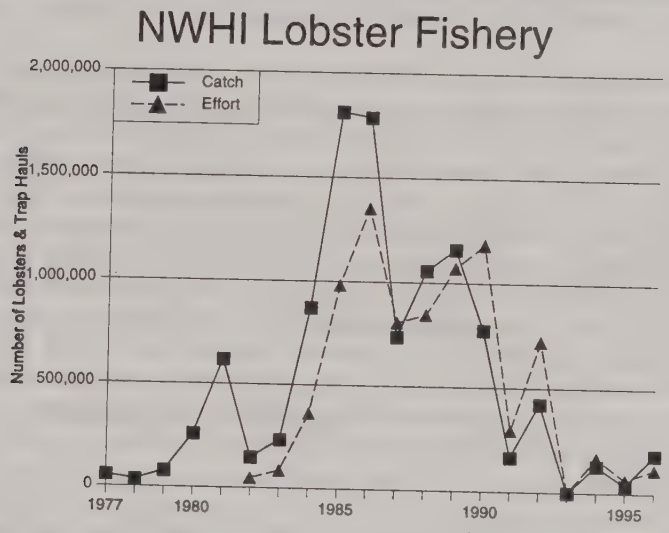


Figure 1. Catch/Effort

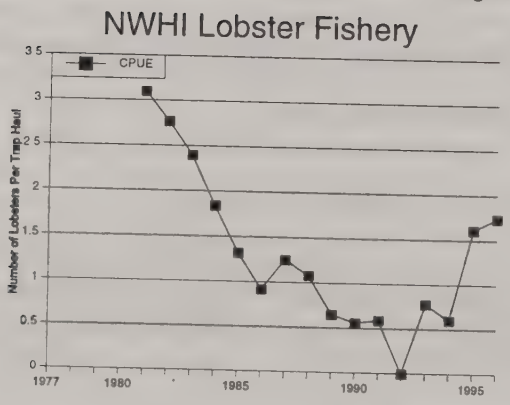


Figure 2. CPUE

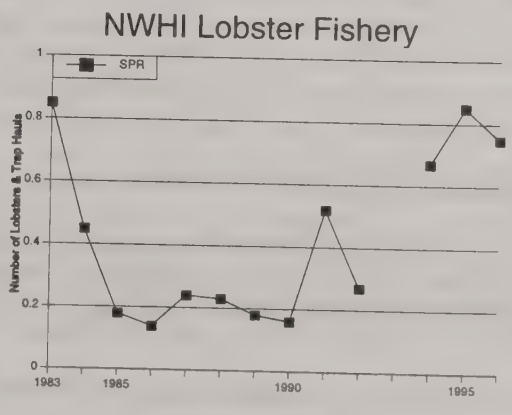


Figure 3. SPR

The status of the NWHI lobster stocks has been assessed by the National Marine Fisheries Service, Honolulu Laboratory (NMFS-HL) on an annual basis since the implementation of the Crustaceans FMP in 1983. Historical data from the commercial fishery logbook time series and the NMFS-HL annual lobster assessment cruise are used to provide information on the population dynamics and stock status of lobster in the NWHI. Overfishing in the Crustaceans FMP is defined in terms of recruitment overfishing, and the basis used to assess overfishing is the spawning potential ratio (SPR). There are two established SPR thresholds in the Crustaceans FMP: a 0.20 minimum threshold level below which the stock is considered overfished and a warning threshold ranging from 0.20 to 0.50 indicating the need for additional conservation measures. Additional criteria to assess the status of lobster stocks in the NWHI include indices of relative spawning biomass and length-specific catch-per-unit effort (CPUE). Although these indices are not mandated criteria of the Crustaceans FMP, they provide complementary metrics for assessing stock status.

Based on length-specific research survey CPUEs, the abundance and median size of lobsters in the NWHI appear to be increasing due to reduced fishing mortality in the NWHI commercial lobster fishery. At Necker Island spiny lobster is the dominant species. Prior to 1990, it was also the dominant species at Maro Reef, while in recent years slipper lobster has become dominant. The switch in species dominance at Maro Reef may suggest replacement by slipper lobster as spiny lobster were fished down and habitat became available. Perpetuating the shift in species dominance was an apparent change in spiny lobster recruitment processes in the northwestern and southeastern portions of the NWHI. Evidence suggests that the circulation pattern in the northwestern region of the NWHI changed in the late 1980s, causing a decline in spiny lobster recruitment since. Data from the 1997 NWHI lobster assessment cruise and commercial fishery indicate that the spatial distribution of slipper lobster at Maro Reef has expanded into areas historically dominated by spiny lobster. Under this scenario it is conceivable that, despite future increases in spiny lobster puerulus settlement at Maro Reef, available habitat may be limiting, and the abundance of spiny lobster may not increase significantly.

The SPR values for the fishery were near the minimum threshold level between 1985 and 1990 (Fig. 3). In response to reductions in fishing mortality, SPR values have been increasing since 1991. The calculated SPR values of 0.79 in 1996 and 0.73 in 1997 are well above the minimum and warning thresholds, indicating that the levels of fishing effort exerted during the 1996 and 1997 commercial fishing seasons, and resulting fishing mortality and exploitation rate, will be insufficient to cause long-term recruitment overfishing under equilibrium conditions.

Goals and Objectives of the NMFS Honolulu Laboratory Lobster Program

The goals of the NMFS-HL lobster research are to provide scientific information and advice for support of the WPRFMC Crustaceans FMP, which includes lobsters and to ensure the long-term productivity of lobster stocks in the NWHI by preventing overfishing. To achieve these goals, the objectives of the NMFS-HL research program include the following:

(1) Monitor and assess the status of lobster stocks in the NWHI.

(2) Set harvest guidelines in the commercial fishery that assure a low risk of overfishing.

(3) Acquire understanding of fleet economics and industry dynamics.

(4) Conduct research as recommended by the NMFS-HL lobster research team.

Major Research Activities

Assess Population Status of Lobsters in the NWHI

Continue to conduct annual fishery-independent research cruises to collect population dynamics and relative abundance data to assess the status of lobster stocks in the NWHI. The research cruises also provide a platform for conducting experiments recommended by the NMFS-HL lobster research team.

Reestimation of Biological and Population Parameters for Spiny Lobster in the NWHI

In accordance with recommendations from the NMFS-HL lobster research team and WPRFMC lobster fishery review panel, a series of spiny lobster tagging studies are proposed for Necker Island in 1998. In addition to estimates of growth and movement, the tagging studies will provide independent estimates of abundance, recruitment, total mortality, natural mortality, fishing mortality, and exploitation rate. To achieve the highest resolution of parameter estimates an at-sea observer program and full cooperation from the fishing industry will be necessary.

Lobster Oceanography, Habitat, and Ecosystem

Joint studies with the Ecosystem and Environment Investigation will continue to advance our understanding of the physical and biological mechanisms contributing to recruitment variability in NWHI lobster populations.

Issue Harvest Guidelines for the Commercial Lobster Trap Fishery

In 1996, the NMFS-HL completed evaluations of alternative harvest strategies for the NWHI commercial trap lobster fishery and formalized a constant harvest rate strategy for setting NWHI harvest guidelines in the commercial fishery. The constant harvest rate strategy incorporates uncertainty in stock assessments and variability in population processes while assuring a low risk of overfishing when determining harvest rates. Harvest guidelines are combined (spiny and slipper) allowable NWHI catch targets (numbers of lobsters). The spatial structure of the NWHI lobster population and nature of the fishery may require future harvest guidelines to be either bank- (e.g., Necker Island, Maro Reef, and Gardner Pinnacles) or area-specific (northwestern and southeastern NWHI).

Sampling of the Commercial Lobster Landings

Annual sampling of the commercial lobster landings will continue. A pilot program to sample the commercial landings at lobster dealers was conducted in 1996. These data will be used to assess stock status and advance future stock assessments methodologies.

Spatially Distinct Dynamic Population Models

The change in recruitment pattern and the associated shift in species composition in the NWHI exemplifies the need for further research which may lead to spatially distinct population models. The current methodology treats the NWHI as a single pooled stock for management purposes. Efforts are underway to develop spatially distinct stage-based population models, and data collected by at-sea observers during the 1997 commercial lobster fishery will facilitate model development.

Provide Scientific Support

Scientific and technical support to the NMFS Southwest Region and the WPRFMC will continue. NMFS-HL scientists also serve on the Crustacean Plan Team.

Lobster Research Team

A research team composed of scientists from the NMFS-HL and the University of Hawaii and managers from the WPRFMC and NMFS Regional Office was established in 1995 to direct and oversee lobster research at the NMFS-HL and to develop a 5-year comprehensive NWHI lobster research plan. The plan was completed in 1996 and is currently being used to implement research activities.

APPENDIX E: HAWAII BOTTOMFISH AND HANCOCK SEAMOUNT ARMORHEAD

HAWAII BOTTOMFISH

Status

The deepwater bottomfish fishery in Hawaii targets a multispecies complex of snappers, jacks, and a grouper. These stocks are annually assessed using fishery-dependent catch per unit effort (CPUE) and size structure of landings from commercial fishermen to estimate the ratio of current spawning stock biomass (SSB) to virgin SSB. A threshold value of 0.20 or 20% is used as an indicator of recruitment overfishing. Bottomfish stocks in the federally managed Northwestern Hawaiian Islands (NWHI) appear to be healthy in both the open-access Mau zone and the more distant and limited-entry Hoomalu zone. In the main Hawaiian Islands (MHI), however, onaga (*Etelis coruscans*) and ehu (*E. carbunculus*) appear to be recruitment overfished, and hapuupuu (*Epinephelus quernus*) is nearly at the threshold level (Fig. 1). NMFS staff continue to work closely with WPRFMC and State of Hawaii staff towards development of a MHI bottomfish management plan.

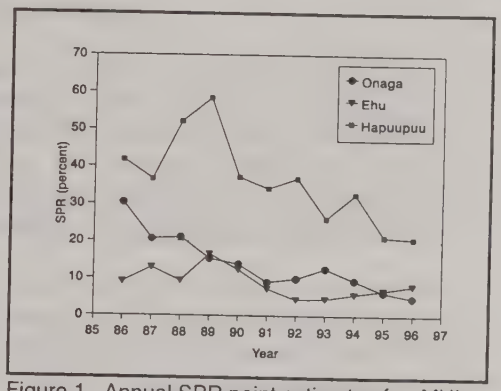


Figure 1. Annual SPR point estimates for MHI onaga, ehu, and hapuupuu (1986-1996).

Management Goal and Major Activities

Maintain sufficient SSB of bottomfish to prevent recruitment overfishing and subsequent recruitment failure. To achieve this goal, research and management activities focus on the following:

- Perform annual stock assessment for the bottomfish management unit species (BMUS) in both the federally managed NWHI and the state managed MHI regions as part of the annual report of the Western Pacific Regional Fishery Management Council.
- Finalize the Mau zone limited-entry amendment to the bottomfish Fishery Management Plan.
- Continue to work cooperatively with WPRFMC, State of Hawaii, and University of Hawaii staff towards management-related research and implementation of management measures to allow recovery of overfished bottomfish species in State of Hawaii waters.
- Perform computer simulations to characterize population recovery trajectories under various management measures.
- Improve the quality of data used in the stock assessment, for both the fishery-dependent data and the pertinent biological parameters such as those related to age/growth, reproduction, and movement. The assessment can also be improved with a better understanding of: 1) shark

and dolphin interactions with fishing activity, 2) catchability by the bottomfishing gear as it relates to size of fish and gear configuration, and 3) stock structure of bottomfish populations.

- Refine the stock assessment methodology as needed, in accordance with new data or new quantitative techniques. Specifically, improvements may be made in the SPR calculation with: 1) continued refinement in the various species-specific CPUE indices, 2) comparison to an archipelago-wide SPR estimator, and 3) application of length-based assessment methods to suitable species.

Preliminary Results (October 1997)

- An advection-diffusion model of larval dispersal was used to investigate potential dispersive abilities of the pelagic eggs and larvae of bottomfish. This model is driven by the monthly geostrophic current fields estimated from Topex/Poseidon satellite altimetry data. These preliminary results indicate that retention/dispersal is highly variable depending on the spawning source, with some areas tending to retain a large fraction of larvae, while other areas appear to retain very few of their larvae. Further research will quantify some of these patterns.

- An archipelago-wide SPR was calculated for the two MHI species which appear to be locally recruitment-overfished. After appropriate weighting factors were applied, the SPRs for onaga and ehu were estimated to be 38% and 43%, respectively. This approach used a simple weighted average of existing SPR's, with bottomfish habitat area in the respective zones as weighting factors. The standardized weighting factors for the MHI, Mau zone, and Hoomalu zone are 0.447, 0.124, and 0.429, respectively.

HANCOCK SEAMOUNT ARMORHEAD RESOURCE

Status

The last NMFS bottom longline stock assessment for armorhead conducted at Southeast (SE) Hancock Seamount in October 1993 derived an estimated biomass of 53 t (Fig. 1). This estimate represents a 2.5% spawning potential ratio (SPR) value which is well below the 20% SPR threshold for overfishing. With the cessation of NMFS stock assessment cruises after 1993, SPR values for Colahan Seamount (located outside the U.S. EEZ) were used as an indicator of armorhead stock conditions at the Hancock Seamounts. These seamounts are similar in having small, shallower summit areas, were similarly fished by the Japan trawl fleet in short pulses, and exhibited similar long-term trends in annual CPUE during the period prior to the moratorium (Fig. 2).

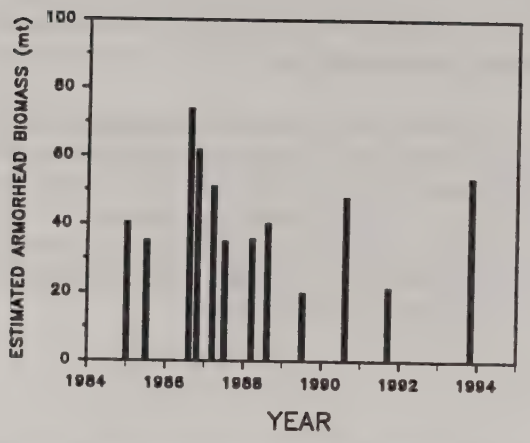


Figure 1. Biomass estimates at SE Hancock based on NMFS bottom longline stock assessments.

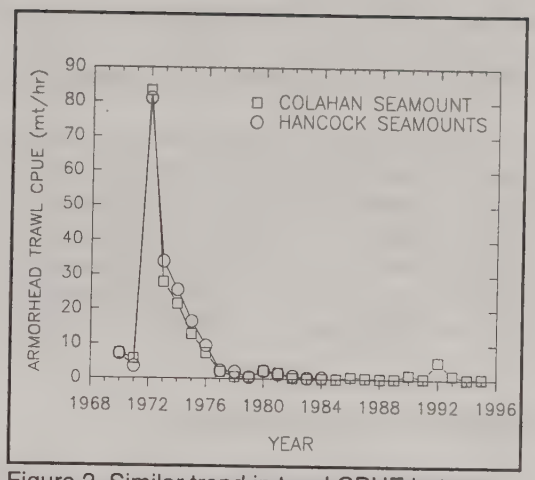


Figure 2. Similar trend in trawl CPUE between seamounts based on Japan trawl fleet data.

Based on Japan bottom trawl fishery statistics provided by the National Research Institute of the Far Seas Fisheries, Shimizu, Japan, the most current (1995) SPR is 1.0% and 1.08% for Colahan Seamount and all seamounts outside the U.S. EEZ combined, respectively. These SPR values indicate very low stock levels exist outside the U.S. EEZ (which constitutes 95% of the trawl grounds and 91% of the total historic seamount-wide catch in the Japan trawl fishery). These results suggest similar low levels exist inside the U.S. EEZ at the Hancock Seamounts (Fig. 3).

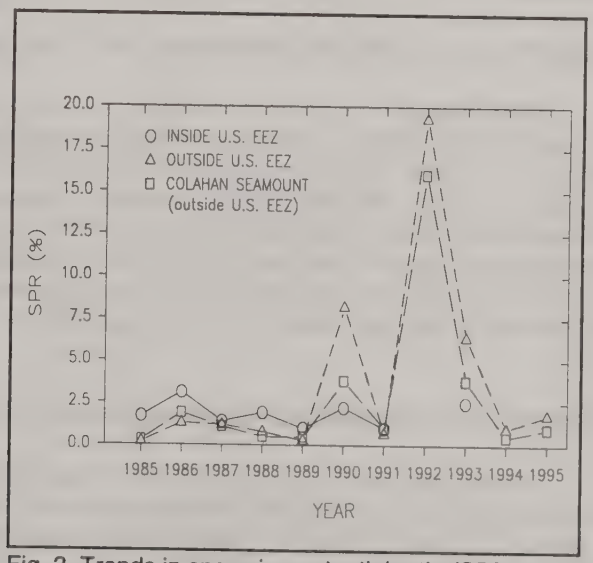


Fig. 3. Trends in spawning potential ratio (SPR) since moratorium at Hancock Seamounts.

Major Research Findings

1998 Moratorium Expiration and Future Management Considerations

In April 1997, the status of the seamount armorhead fishery was presented at meetings before Bottomfish and Seamount Groundfish SSC, the Bottomfish Standing Committee, and Western Pacific Regional Fishery Management Council. At the latter meeting, the Council agreed to extend the current moratorium at the Hancock Seamounts for another 6 years beyond the August 31, 1998 expiration date. The Council will also attempt to initiate contact with Japan (and possibly Russia) to explore the possibility for international management of the entire fishery under the United Nations Agreement Relating to Straddling Fish Stocks and Highly Migratory Fish Stocks.

Pertinent Life History Aspects

Life cycle of armorhead consists of an initial 2+ year nonreproductive, somatic growth phase in epipelagic subarctic North Pacific waters. Armorhead recruit to seamount summits at an adult size during spring-summer months and become vulnerable to capture by the trawl fishery. Electrophoretic and mtDNA studies indicate epipelagic and seamount phase individuals are same species and seamount armorhead constitute a single interbreeding population. Post-recruit armorhead cease somatic growth, began reproductive development, spawn during November-March, and may survive 4-5 years (natural mortality rate estimated at 0.54/year) at the seamounts. Post-recruit movement between seamounts is considered unlikely. Seamount armorhead become emaciated over time and experience an irreversible decline in somatic weight. Annual increases in armorhead biomass at these seamounts is therefore solely dependent on recruitment.

Biological Characteristics Associated With Recruitment Variation

Otolith-based characteristics and size of female recruits were analyzed from years at SE Hancock which received relatively strong (509 metric tons in 1980), moderate (58 t in 1986), and weak (1 t in 1989) recruitment biomass. Mean length of female recruits, and to a lesser extent pelagic duration, decreased with increasing recruitment strength. Otolith growth (in terms of cumulative micro increment width outward from the core) was lowest in the weak recruit year by the end of the first year of the epipelagic phase. An annual cycle of increase and decrease in sequential increment width was observed in all recruit years and suggests the influence of seasonal environmental changes during the epipelagic phase.

Apparent Seamount-wide Recruitment Pulse in 1992 and Subsequent Population Decline

The first substantial increase in seamount armorhead catches since the 1975 decline was harvested outside the U.S. EEZ by the Japan trawl fleet in 1992. A total catch of some 18,000 mt of armorhead was made; the previous 17 years typically yielded annual catches of 1,000-2,000 mt. SPR values for outside the U.S. EEZ (19.3%) nearly exceeded the 20% SPR overfished threshold. However, over the next two years these SPR values declined rapidly to their previous low level. The 1992 increase was apparently due solely to recruitment and not changes in fishing power or the discovery of new trawl grounds. The rapid decline in catches was presumably due to overfishing and

a lack of subsequent recruitment in the succeeding years. Besides the need for international management, the 1992 recruitment event also indicated that large recruitments can originate from low parental stock levels. The 1989 parental stock which produced these recruits had one of the lowest recorded SPR values both inside (1.0%) and outside (0.3%) the U.S. EEZ.

APPENDIX F: WPACFIN, FISHERY MONITORING, AND FISHERY DATA MANAGEMENT

Western Pacific Fishery Information Network (WPacFIN)

WPacFIN is a cooperative agreement between fisheries agencies and fisheries managers in American Samoa, Guam, Hawaii, and the Northern Mariana Islands, and it is also a program of the Fishery Management Performance Investigation (FMPI), known as central WPacFIN.

Central WPacFIN concentrates on four major areas:

(1) Compiling regional fisheries statistics

(2) Providing technical assistance to state and territorial fisheries agencies on fisheries statistics issues

(3) Preparing fishery monitoring and compilation systems, including software development

(4) Providing hardware and software support

Significant progress has been made by WPacFIN in several areas of support for island agencies, WPRFMC plan teams, and Council requirements. One major contributing factor was the hiring of three JIMAR computer programmers using the add-on funds provided last year by the SWR. This has enabled WPacFIN to launch projects for WebSite development and conversion of island data processing systems to a Windows-based environment. WPacFIN staff also provided support to several island agency Plan Team members in producing annual reports for the Pelagics and Bottomfish FMPs. On-site support was also provided by central WPacFIN staff to agencies in Guam and the CNMI during a recent trip to those agencies.

WebSite Development

WPacFIN's new programmer and existing staff have designed the framework development environment for web pages for all the participating island agencies and have begun developing home pages. A Web Server computer was purchased by WPacFIN and implemented by the NMFS Honolulu Laboratory ITS staff to support the WPacFIN web pages. It is currently being tested internally and will be available once web page contents are reviewed and approved by the Laboratory and the Island agencies. This project will be an evolutionary process of adding new and refining old products available on fisheries via the WWW. Only nonconfidential fisheries statistics will be available to external users.

Windows and Database Conversions

Two new programmers were hired to concentrate on the project to upgrade island agency processing environments to more modern software (Windows 95 and Visual FoxPro). New programming standards have been established, and the development team is now using the existing

commercial landings application for American Samoa as a template for developing the new operating environment.

Macintosh System Development

Excellent progress is being made on the new creel survey processing system being developed in the Macintosh FoxPro environment for the Guam DAWR office. Virtually all database structures have been established and data entry/edit routines implemented for them. DAWR staff have successfully loaded data for 1996 and are working on the backlog of other years' data. On a recent trip to Guam, WPacFIN staff worked with DAWR staff on refining and improving the data expansion algorithms which will lead to improved analytical and reporting capabilities for current and historical data, such as splitting charter vs. noncharter boat catch and effort, improving species composition and island-wide statistics, and dividing statistics for the shallow and deep bottomfish complexes.

HDAR Systems Development

Two full-time JIMAR programmers are working with WPacFin and HDAR staff in developing improved processing systems for State of Hawaii data. The focus in the new design is to implement and integrate computerized functions for data quality control, entry, editing, analysis, and report generation. Many cross-referencing databases have been established to improve data quality and validation among sources of data. In addition, WPacFIN staff joined HDAR staff on initial site visits to several Maui dealers to discuss developing an automated dealer reporting system as part of the new integrated HDAR data processing environment.

Fishery Monitoring

The fishery monitoring program is centered in the Fishery Management and Performance Investigation, with the assistance of the Stock Assessment Investigation, the Pacific Area Office of the NMFS Southwest Region, and the Hawaii Division of Aquatic Resources. WPacFIN concentrates on assistance to the state and territorial fisheries agencies.

FMEP (Fishery Monitoring and Economics Program) monitors four fisheries with the following measures and reports:

- Northwestern Hawaiian Islands (NWHI) lobster – logbooks and revenue reports, compiled in an annual report, 1995-97.
- Hawaii longline – logbooks, compiled in quarterly and annual reports
- American Samoa longline – logbooks (collected through collaboration with the American Samoa fisheries agency and the NMFS SWR), compiled in quarterly reports
- NWHI Bottomfish – State of Hawaii logbooks and shoreside monitoring compiled by WPacFIN and FMEP into an annual report and a Council report module

In addition, specialized reports are also prepared:

- *Fisheries of the U.S.* – annual report of western Pacific landings
- Council report module on Hawaii pelagic landings, all gears

FMEP staff are also working on cross-validation routines of longline logbooks through matching records with HDAR landings reports and FMEP shoreside monitoring, working in close collaboration with and providing feedback to the fishing industry, and working to provide timely access of desensitized confidential data for researchers, including regularized aggregation (e.g., 5-degree square summaries and plots).

Fishery Data Management

The Fishery Data Management Program (FDMP) of FMPI provides for the following major functions for research programs at the Honolulu Laboratory:

(1) Data entry, editing, and quality control of research (e.g., *Townsend Cromwell* cruise data) and fishery monitoring data (e.g., longline logbooks)

(2) Design of data recording forms and data bases

(3) Data archiving on multiple media, including scanning and data rescue, and data documentation

(4) Data access to researchers

FDMP regularly handles 50 different active data sets throughout the year. These include information from research cruises, protected species field reports, samples and specimens, U.S. fisheries monitoring, foreign fisheries, economic and shoreside monitoring, and external data bases (e.g., bathymetric, oceanographic, and meteorological).

APPENDIX G: ECONOMIC RESEARCH

Background

Economic research at the Honolulu Laboratory in 1996-97 has concentrated on three topics: Pelagic Fishing Vessel Economics, NWHI Bottomfish Economics, and Theoretical and Applied Research on Alternative Fishery Management Perspectives.

Hawaii Pelagic Fishing Vessels Economics (JIMAR/PFRP, Hawaii Fleet, Industry, and Vessel Economics Project (HIFIVE))

Longline Fishing Dynamics Analysis – Substantial progress has been made in analyzing trip and set level dynamics in the fishery and in evaluating fishing effort. One paper has submitted for publication (Curtis, 1997) and preliminary results of effort categorization were presented at Lake Arrowhead by Travis. This work also contributes to the Travis-Strand project on longline fleet movements between the Pacific and the Atlantic and Gulf coast.

Commercial troll-handline cost-earnings information collection – completed and JIMAR project report being published (Hamilton, 1997).

The troll-handline cost-earnings study was initiated in late1995 with development of an information collection approach and instrument. The fishing community was informed of the project through an article in *Hawaii Fishing News*. Pre-testing was initiated in early 1996 and full fielding was conducted in 1996 with over 500 interviews completed on Oahu, Kauai, Maui, Molokai, Lanai, and the Big Island.

Cost-earnings of charter boat fishing – The charter boat cost-earnings analysis mirrors the troll-handline project, with information collected from all islands. In addition, the project is collaborating with sports fishing tournament interests to provide more information on the intersection of small boat and charter boat fishing and the sports fishing component of the tourism and ocean recreation industry in Hawaii. The next stage of this project will include analysis of charter boat patrons' motivations.

The small boat and charter boat component of the project collaborated with two additional JIMAR projects: a JIMAR visiting scientist project on the socio-anthropology of the distinction between recreational and commercial fishing in Hawaii (a thesis project at the University of Washington) which was extended into an analysis of the sociology of charter boat fishing. The latter was published as a JIMAR research report (Walker, 1997).

NWHI Bottomfish Economics

The NWHI Bottomfish FMP requires an annual assessment of the "optimal" number of vessels for the Ho'omalu (limited entry) zone. This is compiled by Sam Pooley based on recent cost-earnings research (Marcia Hamilton, 1993) and current information on the operations of the NWHI bottomfish fleet (Kurt Kawamoto, 1997). The results for the 1996 season are included in this year's Hawaii module for the Council's annual report on the bottomfish fishery.

Alternative Fishery Management Regimes

Laboratory economist Sam Pooley has published a sequence of papers with Professor Ralph Townsend, University of Maine, on corporate and community approaches to fishery management. The gist of these papers is exploration of reduced central government involvement in the fishery management process. The latest two papers, principally authored by Pooley, are on a community corporation approach to local fisheries (in publication) and a community-based fishery management system (under review).

APPENDIX H: THE HAWAIIAN MONK SEAL

Background Information

The Hawaiian monk seal is the only endangered marine mammal found entirely within U.S. waters. Its population is currently estimated at 1,300 to 1,400 seals and has declined at a rate of approximately 5% per year during the last decade.

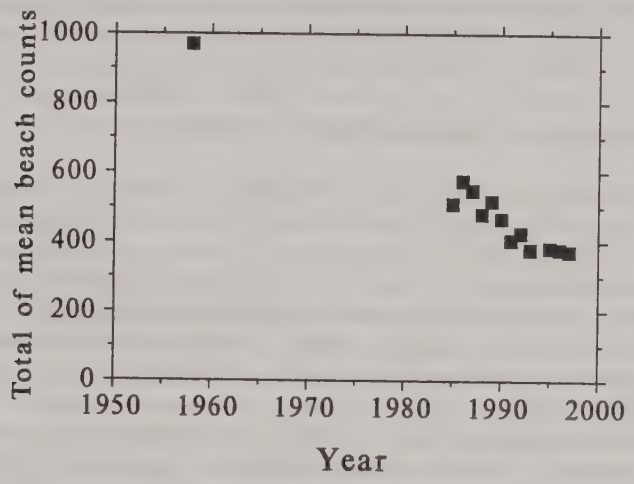


Figure 1. Total of mean beach counts at five of the six main reproductive subpopulations of the Hawaiian monk seal, 1958-97.

Goals and Objectives of the NMFS Honolulu Laboratory Marine Mammal Research Program

The goal of this program is to enhance the recovery of the Hawaiian monk seal population. Program objectives are:

(1) Monitor and assess the six main monk seal reproductive subpopulations on the Northwestern Hawaiian Islands;

(2) Study the ecology, biology, and natural history of the Hawaiian monk seal; and

(3) Investigate and mitigate factors impeding the recovery of this endangered species.

Major Research Activities:

Assess Status of Subpopulations at Main Breeding Locations

Continued evaluation of the main reproductive subpopulations is essential to detect problems impeding recovery, identify management solutions, and evaluate results . This information is critical for modeling and understanding trends observed in the different subpopulations and for predicting the outcome of possible management strategies designed to enhance the recovery of this endangered species. All six of the main reproductive subpopulations will be assessed and information will be collected on abundance, age and sex composition, survival, reproduction, entanglement, behavior, and feeding habits.

Salvage French Frigate Shoals Reproductive Potential

Since 1988-89, juvenile survival at French Frigate has dropped to a catastrophically low level, apparently due to a decrease in carrying capacity resulting from natural variability in ocean productivity and, possibly, competition with commercial fisheries. Decreased juvenile survival has resulted in a decline of reproductive recruitment. To alleviate this situation, undersized pups that would otherwise perish have been rehabilitated and relocated at more favorable sites. Recent growth of the subpopulation at the Kure Atoll is largely a result of the rehabilitation/relocation program, and continued monitoring at Kure is required to assess the success of this program.

Rehabilitation and release efforts were postponed in 1996 due to an unexpected eye affliction of 12 female pups brought to Oahu for rehabilitation (1995). Extensive studies designed to evaluate this eye ailment have been completed, and a panel of expert veterinarians and conservation specialists met in June 1997 to consider the disposition of the 10 remaining seals. The panel recommended that the seals not be released to the wild. Relocation activities will not be resumed until the epidemiological status of donor and recipient subpopulations has been assessed.

Recovery of the Midway Atoll subpopulation

The U.S. Navy vacated Midway Atoll in June 1997, and the U.S. Fish and Wildlife Service has assumed jurisdiction and ownership of the atoll. The Service is maintaining a refuge station at the site through collaboration with a private commercial aircraft company, which is supporting its Midway operations through tourism. Close monitoring of these activities will be essential to ensure that human disturbance is no longer an impediment to recovery of this subpopulation. Historical evidence indicates that Midway Atoll will support a large subpopulations of seals, and the recovery of this subpopulation is a high priority of the monk seal program. Actions to enhance the recovery of this subpopulation have been identified and are being initiated.

Mitigate Mobbing and Its Impacts

In 1994, 22 adult males were removed from Laysan Island to balance the adult sex ratio and reduce the frequency of male-related injuries to adult females and juveniles of both sexes. These

males were translocated to the main Hawaiian Islands and have not returned to Laysan Island. Recent observations indicate that mobbing was significantly reduced during 1995-97. Further monitoring at Laysan is necessary to verify these results, and similar studies and mitigative actions may be indicated at Lisianski Island.

Investigate Pelagic Ecology

Monk seals spend two-thirds of their lives at sea, but little is know about their foraging patterns and distribution in the ocean. Studies of their pelagic ecology are essential to identify and protect the critical marine habitat of the species. Collaborative studies were conducted in 1997 with the University of Minnesota and the National Geographic Society. In 1998, further studies (supported by Saltonstall-Kennedy funding) will be conducted at Pearl and Hermes Reef to allow comparison of foraging patterns of seals at this site and French Frigate Shoals. These studies will be conducted using satellite telemetry, electronic instrumentation, and the NOAA ship *Townsend Cromwell.*

Reduce Entanglement Rates

Each year, monk seals at each of the main reproductive sites are found entangled in marine debris. The impact of entanglement-related mortality on subpopulation growth and recovery is unknown, largely because it is impossible to reliably characterize the entanglement rate. The observed (minimum) rate is on the order of one percent per year, which is more than twice the rate observed for northern fur seals when peak entanglement rates were observed for that species. This minimum estimate is based on seals observed on land; monk seal are also in danger of entanglement in marine debris that is caught or snagged on the extensive coral reefs. To date, little has been done to assess and remove reef debris, though it represents a significant threat to monk seals. During FY97 field operations, onshore marine debris was collected and destroyed at all main breeding sites. With the support of the NOAA ship *Townsend Cromwell,* efforts were also be made to assess and remove debris from coral reefs at French Frigate Shoals. Similar efforts are planned for FY98.

Cooperation With Other Agencies

Each year, the monk seal program promotes and relies on extensive cooperation and collaboration with the U.S. Fish and Wildlife Service, U.S. Navy, U.S. Coast Guard, National Ocean Service, NMFS Southwest Region, NMFS Office of Protected Resources, Hawaiian Monk Seal Recovery Team, and Marine Mammal Commission.

APPENDIX I: PACIFIC SEA TURTLES

Background information

Sea turtles are designated worldwide as threatened and endangered species. Population declines have been prominent in the Pacific Islands as the result of nesting habitat loss and excessive and widespread harvesting for commercial and subsistence purposes. The principal species of concern to Pacific islanders are the green turtle (*Chelonia mydas*) and the hawksbill (*Eretmochelys imbricata*). Both turtles have recently become the focus of considerable conservation efforts by the Regional Marine Turtle Conservation Programme of the South Pacific Regional Environment Programme (SPREP) based in Apia, Western Samoa. The SPREP is a non-governmental organization servicing the environmental needs of 22 Pacific island nations. The Honolulu Laboratory plays a vital role in assisting and advising SPREP in conducting its regional sea turtle program. There is presently the strong desire by native inhabitants of many Pacific islands to reverse declining trends of sea turtles so as not to lose an acknowledged important part of their cultural and nutritional way of life. This task will not be easy due to inherent biological constraints of most sea turtles, which include extensive long oceanic reproductive migrations, vulnerability to predation, unknown pelagic life stages, and slow growth resulting in delayed sexual maturity of 20 or more years.

There are only two loggerhead (*Caretta caretta*) populations in the Pacific, one originating in Australia where serious declines are occurring, and the other in Japan where the numbers of nesting females appear to be stable. Leatherbacks (*Dermochelys coriacea*) inhabiting the Pacific mainly originate from nesting beaches in Mexico and Costa Rica where significant declines have been documented, in Indonesia where their status is uncertain but possibly stable, and Malaysia where the nesting colony is nearly extinct despite 30 years of conservation measures. Both leatherbacks and loggerheads are the species of principal concern with regard to incidental take in pelagic longline and other commercial fisheries of the Pacific conducted mainly by Japan, Taiwan, Korea and, to a lesser extent, the U.S.A.

Green turtles in the Hawaiian Islands are genetically discrete and geographically isolated. This population has responded favorably to 20 years of recovery and research efforts by the NMFS Honolulu Laboratory working in cooperation with the U.S. Fish and Wildlife Service, the State of Hawaii, and several private conservation organizations. The number of green turtles nesting in Hawaii each year has substantially increased on the index nesting site of East Island at French Frigate Shoals in the Northwestern Hawaiian Islands (Fig. 1). However, the total number of nesting females in the population is still well below historical levels and fibropapilloma disease continues to be a threat. The number of green turtles observed in waters around the main Hawaiian Islands has also increased significantly. Turtles in these foraging pastures are mostly immature turtles resulting from the increased nesting success. The greater numbers of green turtles in the main Hawaiian Islands have resulted in more opportunities for tourists and local people to view turtles in the water in the same manner that humpback whales are an ecotourism attraction. The successes thus far achieved in the biological

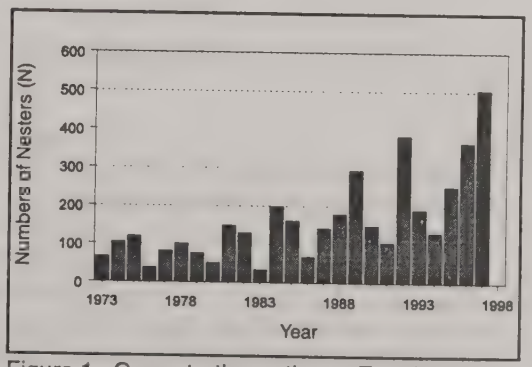


Figure 1. Green turtle nesting at East Island, Hawaii, has tripled since enactment of the ESA.

recovery of the Hawaiian green turtle population constitute a model example in research and management for the rest of the Pacific islands. The olive ridley (*Lepidochelys olivacea*) nesting in the East Pacific has also shown a significant population increase in recent years under protective management and research by Mexican authorities.

Goal of the NMFS Honolulu Laboratory Sea Turtle Program

The goal of the sea turtle program at the NMFS Honolulu Laboratory is to achieve the biological recovery and sustained management of sea turtle populations in Hawaii and other U.S.-affiliated Islands in the Pacific Ocean, and to assist Pacific Island and Pacific Rim Nations to recover sea turtle populations to the degree possible. To achieve this objective, research and management efforts at the Honolulu Laboratory emphasize the following:

Monitoring, assessment, and biological investigations at selected sea turtle breeding sites.

(1) Monitoring, assessment and biological investigations at selected sea turtle foraging pasture aggregations in benthic habitats.

(2) Developing comprehensive, computer simulation models and other quantitative tools to monitor population trends and better facilitate sea turtle recovery efforts and to assess impacts of fishery bycatch.

(3) Assessing post-hooking survival, movements and ecology in pelagic habitats relating to bycatch of sea turtles in longline fishing.

(4) Investigating the pathology, etiology, and epidemiology of fibropapilloma disease.

(5) Conducting cooperative research and providing technical assistance and research training to Pacific Island and Rim Nations to promote the collection, analysis, and sharing of sea turtle data, including fishery bycatch data.

Major Research Activities

Biology, Ecology and Life History

Important progress is being made in understanding the biology, ecology, and life history of green turtles through long-term in-water monitoring at study sites throughout the Hawaiian Islands. Growth rates of immature turtles, diets, habitat characteristics and use, daily foraging patterns, and trends in the number of turtles are being determined. For example, an analysis of data collected on 171 green turtles recaptured one or more times (of 1,458 tagged) at Palaau, Molokai yielded a mean growth rate of only 2.1 cm per year in carapace length. The use of high technology acoustic telemetry and dive recorders is revealing that green turtles undergo exceedingly limited daily movements between underwater resting areas and sites where feeding occurs on selected seaweeds.

The Hawaiian green turtle nesting colony at East Island, French Frigate Shoals has been systematically studied since 1973 in a cooperative program with the U.S. Fish and Wildlife Service.

Approximately 500 migrant females were present in 1997, the highest year on record for the 25 consecutive seasons that nesting has been monitored at this vital location.

Investigation of Fibropapilloma Disease

Fibropapilloma is a tumor-forming and often fatal disease that poses a major threat to the continued recovery of green turtles in Hawaii. An historical perspective showing the initial outbreak and buildup of the disease at a study site on Molokai is given in Figure 2.

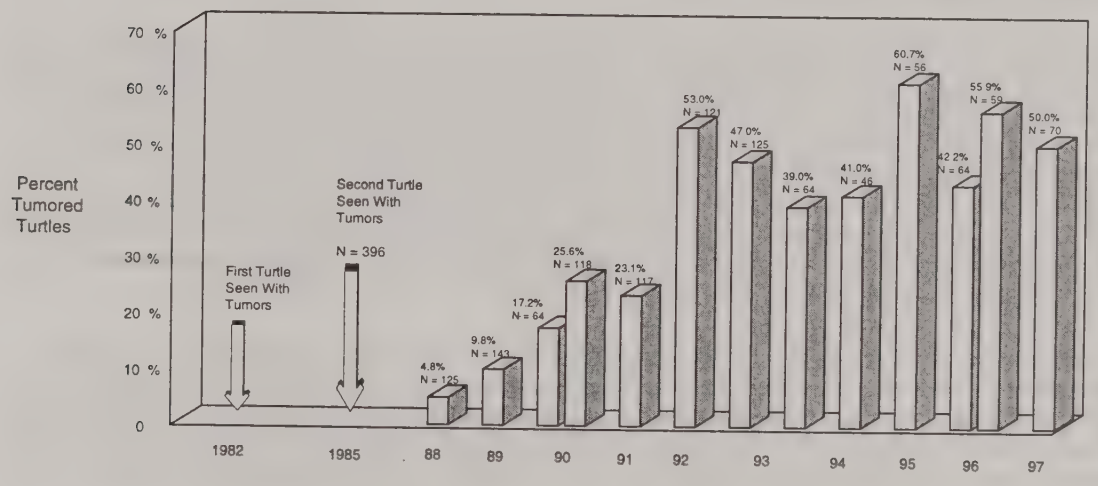


Figure 2. Fibropapilloma disease in green turtles has increased in nearshore habitats along the southern coast of Molokai in the Hawaiian Islands.

It is essential that the cause and mode of transmission of this deadly disease be determined in order to formulate management measures to counter the epidemic in the Hawaiian Islands, as well as to prevent or remedy possible outbreaks in other Pacific island populations. Implementation by the Honolulu Laboratory of the Recovery Plans for U.S. Pacific Sea Turtles is helping to address this threat.

Significant accomplishments have recently been made in determining the etiological agent responsible for fibropapilloma disease. The widespread involvement of a retrovirus and a herpesvirus in Hawaii has now been demonstrated. Vigorous collaborative research by the Honolulu Laboratory is underway with marine disease specialists at the USGS National Wildlife Health Laboratory, JIMAR, Cornell University, the University of Florida, the Armed Forces Institute of Pathology, Leahi Hospital of the University of Hawaii, Colorado State University, and the Department of Environmental Protection in Florida.

Field studies are continuing to assess infection rates of fibropapilloma disease at green turtle foraging pastures throughout the Hawaiian Islands. While the prevalence of the disease is high in several parts of the Hawaiian Islands; e.g., areas of Oahu, Maui, and Molokai, there is currently no evidence of the disease along the Kona Coast of the Island of Hawaii. Health-screening, necropsies, and data analysis also have discovered differences in the disease between green turtles affected in the Pacific and Atlantic Oceans. Namely, turtles affected in the Hawaiian Islands have a significantly higher incidence of tumors in the oral cavity, whereas fibropapilloma tumors are not found in the oral cavity of affected turtles in Florida and elsewhere. This finding indicates that different measures may be required to mitigate fibropapilloma disease at affected locations. The growth rates of turtles with tumors are significantly slower than non-tumored turtles.

Fishery Interactions With Sea Turtles

The Honolulu Laboratory plays a central role in the research, monitoring, and mitigation of sea turtle interactions with commercial fisheries. In particular, the Laboratory provides critical support to the scientific observer program conducted by NMFS since 1994 to monitor the interactions of the Hawaii high-seas longline fishery with sea turtles. Honolulu Laboratory staff carry out sophisticated statistical analyses of observer data to assess the total magnitude of the fishery's interactions with turtles and identify the oceanographic, biological, or operational factors associated with such interactions. Estimates of the level of interactions and resulting mortality are then combined with computer simulation models to evaluate the impacts of the fishery, and other sources of mortality on sea turtle populations in order to devise mitigation efforts.

Biological studies by the Honolulu Laboratory are also being conducted to improve the assessment of fishery impacts on turtles. During monitored longline fishing trips, NMFS vessel observers tag turtles, collect life history data, and take small biopsies of turtle tissue. When analyzed by the La Jolla Laboratory, these samples reveal the genetic origins of the turtles and show which nesting colonies, in various parts of the Pacific, are impacted by the Hawaii-based longline fishery.

Satellite Tracking of International Pacific Turtle Migrations

NOAA's polar-orbiting satellites are being successfully used to track the movements of sea turtles across the Pacific Ocean. The information from this unique research conducted by the NMFS Honolulu Laboratory is essential in promoting international sea turtle management plans for the Pacific islands. Except for the Hawaiian Islands, sea turtles are an internationally shared resource throughout the Pacific. For example, satellite tracking has discovered that green turtles nesting in American Samoa migrate to and from Fiji, passing through the waters of Tonga in the process. This technology has also shown that Hawaiian green turtles make migrations back and forth to the Northwest Hawaiian Islands where they nest at French Frigate Shoals. In addition, NMFS observers have been trained to place small satellite transmitters on live turtles released after incidental capture in Hawaii-based longline pelagic fishing. These transmitters provide critical information on the oceanic movements of pelagic turtles and are the only basis available to evaluate post-hooking survival.

Assistance and Cooperative Research with South Pacific Islands and Pacific Rim Nations

Substantial progress is being made in research activities and information exchange through the Regional Marine Turtle Conservation Programme of SPREP. Important bonds of cooperation have been established and are being strengthened with turtle researchers and their programs in Tahiti, Fiji, Samoa, CNMI, Japan, Indonesia, the Philippines, Taiwan, Mexico, Costa Rica, and elsewhere throughout the Pacific. The Honolulu Laboratory is also conducting periodic research training sessions for Pacific Islanders in the areas of data collection, tagging, experimental design, necropsies, and procedures for monitoring and assessing sea turtles populations.

APPENDIX J: INTERACTIONS OF THE HAWAII-BASED LONGLINE FISHERY WITH SEA TURTLES AND SEABIRDS

Background Information

During fishing operations by Hawaii-based pelagic longline vessels, sea turtles and seabirds occasionally become hooked or entangled in the gear. The resulting incidental fishing mortality to the turtle and bird populations is a cause of concern because the affected species are endangered or threatened. During FY 1997 the Stock Assessment Investigation devoted significant effort to better understanding interactions of the Hawaii longline fishery with sea turtles and seabirds. Under the Biological Opinion concerning the Hawaii longline fishery, NMFS is required to estimate levels of incidental take and mortality of sea turtles in the fishery and assure that current mortality levels do not jeopardize the recovery of affected turtle populations. Estimates of seabird mortalities caused by the fishery are also computed and provided to the U.S. Fish and Wildlife Service, which has jurisdiction over seabird monitoring and recovery. Data to assess longline interactions with turtles and seabirds are collected through NMFS-mandated logbook and observer programs.

Goals and Objectives

The goals of the NMFS Honolulu Laboratory turtle and seabird longline-interactions research are to provide the scientific information required for sound population recovery and fishery management decisions. The objectives of the research during FY 1997 were to:

(1) Estimate takes and mortalities of turtles and seabirds in the fishery.

(2) Analyze factors that may be associated with high incidental take rates.

(3) Evaluate the statistical design of the observer program.

(4) Assess longline fishery impacts on turtle populations.

(5) Provide support to the SWR in carrying out an ESA Section 7 consultation on the Hawaii longline fishery and developing a revised Biological Opinion.

Major Research Activities

Estimation of Takes, Mortalities, and Associated Factors

During FY 1997, turtle takes and mortalities for all 3 years were estimated using a regression tree method and compared with the allowable numbers of takes and mortalities (Table 1). Confidence bounds for the point estimates and probabilities that actual takes and mortalities (as opposed to point estimates) exceeded the allowable levels were estimated by a bootstrap procedure. Turtle data from the 3 years were combined in a single analysis with year as an independent variable to reveal the degree of annual variability. Although there was some change in the point estimates from year to year, the changes were not statistically significant due to the large degree of variability in the data, as indicated by large confidence ranges. The same result was true for the great majority of 24 other factors tested for their influence on turtle interactions (see Table 2). Only latitude and, to some extent, swordfish catch were significantly associated with loggerhead interactions, and yellowfin catch was significant for olive ridley interactions. No significant factors emerged for leatherback or green turtles. Lack of significance was again attributable to the high degree of variability and also to the fact that the factors are highly intercorrelated. The statistical noise and low statistical confidence in the estimates is due to the paucity of observed turtle interactions (only 106 observed takes for all turtle species through the end of 1996). This results from the low (~5%) coverage rate of the observer program and from the rarity of turtle interactions. Since the Biological Opinion must lay out a program for the future, it is suggested that statistical confidence in take and mortality estimates could be improved by increased coverage rate of the observer program and by accumulating data over several years. Methods, assumptions, and results of turtle take and mortality estimation were described in an administrative report (Skillman and Kleiber, 1997).

Table 1. Point estimates and 95% confidence limits of annual takes of sea turtles and albatrosses in the Hawai'i-based longline fishery. Allowable take levels for sea turtles were set by biological opinion process under the Endangered Species Act. Allowable take levels for albatrosses have not been determined as yet.

	1994	1995	1996	Allowable Takes
Sea Turtles:				
Loggerhead	301 212 – 447	339 225 – 476	358 237 – 481	305
Olive Ridley	120 60 – 179	123 66 – 184	129 68 – 193	152
Leatherback	132 87 – 202	156 103 – 239	159 104 – 243	271
Green	34 15 – 81	41 18 -- 96	42 18 -- 97	119
Albatrosses:				
Laysan	1219 97 – 1487	246 2017 – 2807	625 441 – 816	---
Black-footed	2594 2165 – 2970	2186 1791 – 2539	1189 923 – 1441	---

Regression tree analysis of the albatross data has not yet been conducted. In this case, take estimates were obtained by applying the takes per hook in observed longline sets to the total number of hooks deployed by the fishery. Confidence regions were somewhat tighter than for turtles (Table 1)

because albatrosses are taken in considerably greater numbers than turtles (272 Laysan and 193 black-footed albatross takes observed during 1994-96).

Table 2. Independent variables tested for statistical significance in affecting probability of turtle interaction.

variable	contents
latitude	degrees
longitude	degrees
year	94; 95; 96
month	Jan -- Dec
time	0001 - 2400
hooks	count
hooks/float	<17; >17; unknown
bait	6 categories
light sticks	count
temperature	<22C; >22C; unknown
bigeye	catch in #
yellowfin	"
skipjack	"
albacore	"
swordfish	"
blue shark	"
mahimahi	"
striped marlin	"
blue marlin	"
wahoo	"
spearfish	"
opah	"
albatross	"
vessel length	registered length
target	7 categories

Turtle Population Dynamics and Fishery Impacts

The SAI further developed a computer simulation model of sea turtle population dynamics (TURTSIM) that integrates information on life history parameters and mortality caused by a range of human activities. The simulation model was applied to the Japanese loggerhead population, which accounts for most turtle takes in the Hawaii-based longline fishery, and the severely depleted leatherback populations of Malaysia and Mexico. Little is known about the growth, maturation, remigration, reproduction, and natural mortality of these populations, so the simulations have been based largely on educated guesses of parameters. Likewise, levels of human-caused mortality, ranging from egg harvests, mortality to nesting females and incidental mortality in coastal and high-seas fisheries are unknown in most cases. Despite such uncertainties, TURTSIM studies have provided useful indications of the impact of the Hawai'i longline fishery. Provisional results suggest that the turtle populations would readily recover if the Hawai'i longline fishery were the only source of human-caused mortality. As expected, the studies have also shown that sustainable levels of incidental fishing mortality in the Hawai'i fishery are greatly affected by levels of mortality to eggs and nesters, and levels of turtle mortality in other fisheries. Thus the problem of recovering diminished turtle populations while maintaining healthy and productive fisheries is complex, and cannot be solved without multinational cooperation. Preliminary assessments of the Hawaii-based longline fishery's impacts on turtle populations, based on TURTSIM simulations, and related background information for the Section 7 consultation were issued in an administrative report (Wetherall, 1997).

APPENDIX K: DIRECTOR'S OFFICE, ADMINISTRATION, INFORMATION AND TECHNICAL SERVICES

Director's Office and Administration

Many noteworthy accomplishments were made through the Director's Office during FY 97. The Lab increased its visibility in the community through staff participation in 18 different community outreach events. Significant strides were made in the area of environmental compliance and safety. A major disposal of hazardous wastes and chemicals was completed, inventories updated, staff trained, and the removal of two UST's completed. A complete status of Environmental Compliance activities can be found later in this Appendix. Major renovations of the Kewalo Research Facility included new fence and security gate, repaving, replacement of covered storage area, acquisition of a new chemical van, major electrical replacement, new lighting, installation of new seawater pump and well, fiberglass repair of a seal enclosure, pumphouse addition, and installation of closed-circuit TV.

FY 1997 was a year of significant change for the Administration Group. Key personnel changes involved the hiring of a new Administrative Officer in January, a new Budget Assistant in March , and a new Purchasing Agent in September. Despite the turnover and periods of not having a full staff, the group was able to successfully meet or exceed expectations in providing service and support to the laboratory staff, complying with reporting requirements, and coordinating overall management of administrative matters affecting the lab.

Safety issues cited in 1 1997 safety review were completed, and security upgrades were implemented. An administrative procedures manual was developed and distributed. Several positions at the lab were desk audited. Those upgraded had revised position descriptions and GWPAS created. Relationships with the JIMAR staff were strengthened resulting in clarification of responsibilities and a more detailed accounting system instituted. A number of training efforts were made available to lab employees including Prevention of Sexual Harassment, Procurement, Alternative Dispute Resolution, Hazardous Materials Training, Dangerous Goods Shipment , and pre-Retirement Training. Graphics and illustration capabilities were greatly enhanced this year with the acquisition of a new color printer, color calibration kit, new computer, and large screen monitor.

The Administrative Officer received an on-site orientation from the La Jolla staff; the Administrative Officer and the Budget Assistant visited WASC for an orientation.

Information & Technical Services

Many improvements and upgrades were competed in the areas of computer communications, security, software, and hardware. The Laboratory computer LAN system was updated with the installation of new Netbuilder II router and the installation of electronic hubs and switches to upgrade the LAN capability from 10 mbps to 100 mbps between main Laboratory and Annex 1. The installation of twisted pair wiring was also completed in about one-third of the main Laboratory. The communications line between the Kewalo Research Facility and the main Laboratory at UH Manoa was upgraded to T1 capability and the number of networked systems at Kewalo facility was increased to accommodate the expansion in the protected species research and operations. In addition, a

dedicated 56 kbps communications line was established between the Honolulu Laboratory and the Center in La Jolla for FRS operations.

Computer security measures initiated included the configuration, installation, and testing of a firewall to assist in protecting Laboratory networked computer systems from unauthorized access. The Laboratory computer resource policy was also revised to include additional security steps.

Several actions were taken to improve the performance of the Oracle database system, including a major overhaul of disk space on the host, installation of the new 7.3.2 version of Oracle and reorganization of the Oracle databases. In addition, Oracle forms were designed, tested, and implemented and training was provided to observers from lobster vessels for entering data gathered during the 1997 fishing season directly into the Oracle database.

A number of major software packages used at the Laboratory were upgraded, including: ccMail to version 8.0, WordPerfect to Corel Suite, SigmaPlot, Windows NT v 4.0 Microsoft Office 97, and Netscape Communicator. Several computer hardware upgrades were also completed including installation of a new Windows NT 4.0 server to serve as domain controller and to support the new Corel Office Suite software, three World Wide Web servers (for the Laboratory, WPacFin, and CoastWatch), and a 15-tape DLT unit on the IT-95 system to allow backing up priority systems located throughout the Laboratory. Major computer upgrades and installations were also completed for the NOAA CoastWatch Site including two new computer systems for collecting, processing, distributing, and archiving CoastWatch data products derived from HPRT AVHRR infra-red and SeaWiFS ocean color satellite data.

Environmental Compliance

Under contract with WASC, the U.S. Army Corps of Engineers conducted an Environmental Compliance Assessment of the main Honolulu Laboratory and the Kewalo Research Facility in November 1995. A final report of the assessment issued May 6, 1996 cited 37 negative findings (see Table 1) and 2 positive findings regarding environmental compliance. Thirty of the negative findings have been corrected and actions to correct the remaining five are underway or funding is pending to remedy them.

Table 1. Summary of negative findings from environmental compliance assessment of the Honolulu Laboratory and remedial actions

Type of negative finding	No. Found	Corrected
Currently out of compliance with existing law, permit, or agreement	13	9
Will be out of compliance in the future if not corrected	3	1
OSHA requirement related to human health and safety	15	15
No statutory requirement, but recommend correction	6	5
TOTAL	37	30

Completed Environmental Compliance Activities

1. Prepared Hazard Communication Plan – Copy on file in Administration Office.

2. Prepared Chemical Hygiene Plan – Copy on file in Administration Office.

3. Staff training on hazardous – Conducted by Merle Marrow, Environmental Compliance Officer from SWFSC.

4. Staff training on hazardous material inventory – Conducted by Merle Marrow, Environmental Compliance Officer from SWFSC.

5. Hazardous material inventory – Copy on file in Administration Office.

6. Material Safety Data Sheets (MSDS) posting – Appropriate MSDS sheets posted in storage and user areas.

7. Large chemical spill kits – Placed in appropriate areas in Annex II and chemical lab.

8. Staff training (4) on shipping diagnostic specimens and infectious substances (IATA Dangerous Goods Regulations) – Conducted by Sue Ann Roberson of Aloha Airlines.

9. Staff training (3) on medical wastes and contaminated sharps – conducted by University of Hawaii.

10. Annex II cleanup and rearrangement.

11. Chemical Storage – Flammable and corrosive chemicals stored in appropriate lockers in Annex II.

12. Disposed of hazardous waste and excess chemicals.

13. HL EPA hazardous waste generator status determined – Conditionally exempt small generator.

14. Sign posting – Asbestos warning, no smoking, and exit signs posted in appropriate areas.

15. Flammable air-conditioned storage locker installed at KRF.

16. Disposed of 500-gal fuel storage tank at KRF.

17. NOAA Pre-Audit Survey for Environmental Compliance.

18. Facility radon test results on file in Administration Office.

19. Posting of informational and "Right To Know" hazardous signs in appropriate areas.

20. Compressed gas cylinders properly secured, labeled, and posted with appropriate warning signs.

21. Employees performance plans have been revised to include compliance with environmental requirements.

22. Environmental Compliance Officers have been designated for our facilities: Paul Shiota for HL and Robert Dollar for KRF.

23. Two underground fuel storage tanks removed at HL.

In Progress

1. Two flammable and one corrosive chemical storage cabinets on order

2. Staff training on hazardous materials to be conducted by WASC.

3. Labeling of all specimen containers with appropriate hazardous material labels.

4. Repair damaged storm water discharge pipes at HL – Pending review of new facility planning.

5. Prepare an Infectious Waste Management Plan – Presently covered briefly in our Chemical Hygiene Plan. A more detailed plan is desirable.

6. Locate records for PCB light ballasts disposal.

7. Conduct a facility PCB survey – Pending recommendations from WASC.

8. Ocean discharge permit at the KRF – Pending review.

To Be Addressed

1. Install eye wash stations for chemical laboratory and specimen sink in Annex II, three office/labs in main laboratory building and physiology laboratory at KRF – Pending funds.

2. Install chemical spill kits for three office/labs in main laboratory building and physiology laboratory at KRF – Pending funds.

3. Revise Emergency Preparedness Plan.

4. Locate records for formalin exposure.

5. Rearrange specimen processing in Annex II.

6. PCB determination: Annex I transformer and pole-mounted transformers between Annex I and Annex II.
7. Installation of 0.25-inch screens at drains and a neutralization system for HL – Pending funds.

APPENDIX L: ORACLE DATABASE DEVELOPMENT

Background

The Honolulu Laboratory has practiced centralized data management for much of its history. Centralized management and archiving of data forms has proceeded storage of data sets on magnetic tape. This storage media has been the standard for long-term archiving of data since computers came into use at the Laboratory. While centralized management of data files has provided considerable benefit, access to these flat files not directly mounted on any computer system is cumbersome and inefficient by today's standards. The Honolulu Laboratory viewed the adoption of Oracle as the high-end standard database management system by NMFS headquarters in 1993 (an IT95 effort) as a means of modernizing our computer processing capability. The SWFSC in La Jolla undertook the development of a pelagic database in Oracle in mid-1994 (November after a meeting of the System Administrators in Seattle), which was later generalized to an "enterprise model." Independently, in mid-1994 the Honolulu Laboratory undertook the development of an Oracle database for Hawaiian monk seal research data. In July 1995, via a contract with Oracle Corporation and a working group, the Honolulu Laboratory joined La Jolla in collaboratively developing the SWFSC enterprise model, specifically considering pelagic and marine turtle data sets of importance in the central/western Pacific. The contracted Oracle developer successfully loaded the 1994 Longline Logbook data into the database in September 1995. On December 4, 1995, a Honolulu Laboratory Oracle Development Team was born. The team consists of three species-oriented working groups:

Oracle Monk Seal Working Group,
Oracle Pelagic Working Group, and
Oracle Turtle Working Group.

Goals and Objectives

The management goals are

(1) An Oracle-based Honolulu Laboratory enterprise database holding and providing access in the short-term to monk seal, pelagic fisheries, and sea turtle data sets and later to environmental, other fishery/resource, and administrative data; and

(2) Access to this database for Laboratory scientists, the WPRFMC, and other users via the World Wide Web.

The following objectives support accomplishing this goal:

(1) Develop expertise at the Honolulu Laboratory in Oracle database development, SQL and SQL plus programming, Oracle Forms, Oracle Reports, etc.;

(2) Enter key pelagic fishery data sets into the Oracle database, with revisions to the fixed enterprise model made as necessary and in collaboration with La Jolla;

(3) Enter marine sea turtle research data into the fixed enterprise model in collaboration with the pelagic development effort;

(4) A functional Hawaiian monk seal Oracle database;

(5) Conversion of the monk seal Oracle database to the fixed enterprise model;

(6) User access to fixed and customizable reports, database browsers, and to detailed data as appropriate;

(7) Incorporation of environmental, other fishery/resource, and administrative data into the Honolulu Laboratory database.

Major Research Activities

Monk Seal Working Group

The monk seal database was developed prior to and for now remains separate from the enterprise model being operated by the Pelagic and Turtle Working Groups. This is a fully functional database being used for the second year for entering data brought back from the field camps in the Northwestern Hawaiian Islands and for preparing of annual reports and other data summaries.

Turtle Working Group

The laptop-based data entry system has been converted to Microsoft Access and improved, with the goal of loading directly into the Oracle enterprise database. The group leader has consulted with the Oracle database administrator and the Oracle Pelagic Working Group on database design and implementation issues.

Pelagic Working Group

The goal of having a functional pelagics database by March 15, 1997 was achieved. The Western Pacific Longline Logbook and Western Pacific Longline Observer data sets through 1995 were entered into the Oracle enterprise database, and two reports distributed to the NMFS offices and the Western Pacific Regional Fishery Management Council were reproduced. The first report, which is distributed quarterly by the Laboratory, summarizes fish catches and fishing effort by geographical areas based on the logbook data. A fixed version duplicating the last distributed report was made available and options for producing customized reports were also provided. Later, a page summarizing protected species interactions was added..

The second report, also distributed quarterly, but by the Southwest Region, duplicated a report on protected species derived from the observer data. In addition, the ability for viewing the geographical distribution of observer trips (and turtle takes) compared to the distribution of longline fleet trips was provided by linking the Oracle report with a geographical plotting program. While not

part of the requirement for having a functional database, the lobster logbook data set was loaded to allow additional checking of the functionality of the model. Since then, the working group has been addressing issues such as how data set names are handled in the current model (the original did not consider them at all), more efficient means of loading the flat files, and standardizing (object names, directory structures, and documentation). Recently, a new version of Oracle (7.3.2) has been loaded onto the IT95 UNIX computer requiring that all computer codes for generation of views, secondary tables, and Oracle forms, menus, and reports, etc. be checked. Performance problems with the new implementation are being investigated. In addition, an Oracle procedure for entering lobster observer data was implemented on short notice. An Oracle data entry procedure was developed for use on personal computers, rather than having inexperienced SWR observers deal with X-windows and UNIX in general. As with the monk seal data, the entered data were placed in a "temporary" Oracle table and will be moved to the "permanent" tables of the enterprise database after verification and checking.

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APPENDIX N: MISSION STATEMENTS

Investigation Chiefs Team

The mission of the Investigation Chiefs Team is to provide direction and leadership, plan, establish policies, resolve issues, allocate resources, coordinate activities, and represent the Honolulu Laboratory. We achieve our mission by facilitating two-communication, building trust and a positive lab spirit, stimulating discussion, and motivating and rewarding our people.

Guiding Principles

(1) Maintain integrity and honesty – scientifically, professionally, and personally.
(2) Demonstrate appropriate leadership skills and behavior.
(3) Act with benevolence (be understanding, forgiving, and caring)
(4) Strive for excellence.
(5) Nurture mutual respect and trust in relationships (be supportive, positive, and respectful.
(6) Cultivate loyalty and commitment.
(7) Be realistic and use foresight in problem solving.
(8) Be accountable and maintain credibility.
(9) Demonstrate persistence and tenacity.
(10) Always operate with purpose, direction, and timeliness.

Oracle Team

The mission of the Honolulu Laboratory Oracle Team is to support better fishery management and protected species recovery, by providing uniform data management that will increase efficiency, improve access to data by other laboratories, facilitate the research and interdisciplinary data analysis, and better serve the user-customer.

Guiding Principles

- Cooperation and teamwork.
- Tolerance and willingness to listen to others.
- Honesty, openness, and trust.
- Respect for each other and for our priority needs.
- Willingness to participate and to learn.
- Supporting other team members in development of skills.
- Working hard and realistically.
- Giving and accepting appropriate feedback in a positive manner.
- Being respectful, resourceful, responsive, and responsible.
- Operating always with purpose, direction, and timeliness.